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THE ANNALS
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INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY'.)

CONDUCTED BY

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" Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiarum felicitatis humanæ :—ex harum usu *bonitas* Creatoris ; ex pulchritudine *sapientia* Domini ; ex æconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata ; à verè eruditis et sapientibus semper exulta ; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

" Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

..... The sylvan powers
Obey our summons ; from their deepest dells
The Dryads come, and throw their garlands
And odorous branches at our feet ; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep ; the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide : the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

".....per litora spargite muscum,
Naiades, et circum vitreos considite fontes :
Pollices virgineo teneros hic carpite flores :
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas
Ite, recurvato variata corallia trunco
Vollite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasi, Ecl. 1.

No. 85. JANUARY 1945.

I.—On two *Echinostome Trematodes* from Grebes. By
STEPHEN PRUDHOE, Department of Zoology, British
Museum (Natural History).

IN this paper some account is given of two echinostomes belonging to a group possessing 19 spines on the "head-crown," and found mainly in grebes (*Podiceps* spp.). This group has long been of uncertain generic status, but recent writers have provisionally assigned most of its species to the genus *Petasiger* Dietz, 1909.

The species found in grebes and belonging to this particular group are: "*Petasiger*" *pungens* (Linstow, 1894), "*P.*" *neocomense* Fuhrmann, 1927*, "*P.*" *nitidus* Linton, 1928, "*P.*" *novemdecim* Lutz, 1928, "*P.*" *lobatus* Yamaguti, 1933, "*P.*" *grandivesicularis* Ishii, 1935, "*P.*" *australis* Johnston and Angel, 1941, *Echinostomum megacanthum* Kotlán, 1922, and *Echinoparyphium brevicauda* Ishii, 1935. The description of the last-mentioned

* Fuhrmann distinctly states the number of spines in *P. neocomense* to be 19, not 27 as given by some recent writers.

species very closely resembles that of "*P.*" *lobatus*, and a re-examination of both forms would probably reveal that they are synonymous. With regard to *E. megacanthum*, most writers are agreed in recognizing its similarity to "*Petasiger*," but have, for reasons not stated, refrained from including it in that genus. It therefore seems that, if only for the purpose of consistency, *E. megacanthum* should likewise be provisionally assigned to *Petasiger*. Furthermore, "*P.*" *neocomense* and "*P.*" *nitidus* are regarded by the writer as synonyms of *E. megacanthum*.

Whether the species of the group in question are actually congeneric with *Petasiger exaeretis* Dietz, 1909, the genotype, is a question that cannot be satisfactorily answered without resorting to a comprehensive study, based on ample material, of the genera *Echinostoma*, *Echinoparyphium*, *Euparyphium*, *Paryphostomum* and *Petasiger*, more especially of their type-species, with a view to defining their generic differences more convincingly. The need for this revision has become apparent in recent years through the erection of many new species which have been referred to different genera, but which might equally well belong to the same genus. Thus even the determination of the genera has become an extremely difficult problem.

"*Petasiger*" *pungens* (Linstow, 1894) Fuhrmann, 1927.
(Fig. 1.)

Syn.: *Distomum pungens* Linstow, 1894; *Echinostomum pungens* Stossich, 1899; "*Petasiger*" *neocomense* (?) of Baylis, 1939.

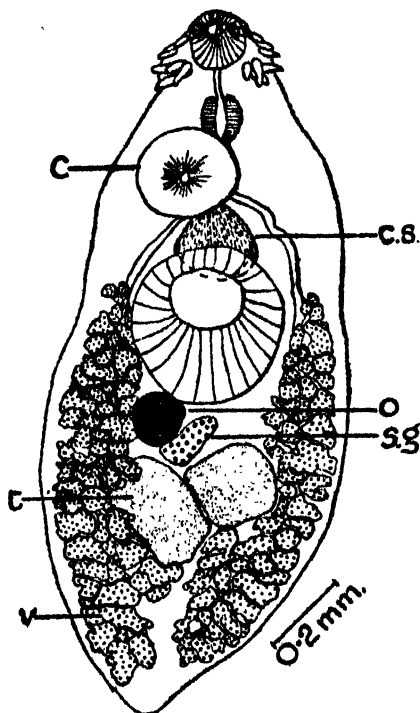
The original description of this species was based on a single specimen which Linstow found in the intestine of *Podiceps minor* [= *ruficollis*] from the Seeburger See in East Prussia. Odhner (1910, p. 123) briefly described and assigned to this species a single specimen from *Podiceps cristatus* in Germany, but, by reason of the structure of its cirrus and cirrus-sac, this specimen appears rather to belong to "*Petasiger*" *megacanthus*. Fuhrmann (1927) examined and partially redescribed the original specimen, and stated it to be strongly flattened.

The British Museum (Natural History) possesses three sets of specimens, thought to be of this species, obtained from the little grebe (*Podiceps ruficollis*) in Kent, Hampshire and an unknown locality in England. Although

there are certain differences in the relative measurements of these specimens and the type, it is thought that the excessive flattening of the latter has exaggerated many of them. Consequently it seems desirable, on the basis of the present material, to describe this species more fully.

The body is broadly oval or pyriform, varying in length between 1 mm. and 1.7 mm. (2.99 mm.)*, and in maximum

Fig. 1.



"Petasiger" pungens; ventral view; c., everted cirrus; c.s., cirrus-sac; o., ovary; s.g., "shell-gland"; t., testis; v., vitelline follicles. (Uterus omitted.)

width, which occurs behind the ventral sucker, between 0.4 mm. and 0.7 mm. (1.14 mm.) The entire ventral surface is armed with scale-like spines, but dorsally they are present only on the anterior half. The "head-crown"

* The measurements in brackets are those given by Linstow or Fuhrmann.

measures 0.2–0.3 mm. in diameter, and bears 19, or exceptionally 18, spines (19–21, according to Linstow). The eleven marginal spines are arranged in a single row, and measure 0.048–0.064 mm. in length (0.078 mm.). In two or three of the larger specimens the five dorsal spines show, under high magnification, a slight tendency to form a double row. According to Linstow's figure, these spines are definitely arranged in a double row, but it is questionable whether this arrangement has not been emphasized by pressure or contraction, or a combination of both*. The spines on each ventral lobe of the "head-crown" are arranged in two pairs, one above the other, and measure 0.084–0.1 mm. in length (0.109 mm.). The oral sucker measures 0.08–0.12 mm. in diameter (0.18 mm.) and the ventral sucker 0.25–0.4 mm. (0.5 mm.). The pharynx is elongate, measuring 0.075–0.1 \times 0.07–0.098 mm. The oesophagus is usually about as long as the pharynx, but may reach a length one and a half times as great. The genital pore lies in the median line close in front of the ventral sucker. It is rather wide, being about 0.08 mm. in diameter. The almost globular, extremely thin-walled cirrus-sac lies on the antero-dorsal surface of the ventral sucker, and measures about 0.2 mm. in diameter. A very large number of prostatic cells is present in the sac. The seminal vesicle is well developed and bipartite. When everted, the cirrus takes the form of a large bulbous structure, with a diameter varying between 0.16 mm. and 0.23 mm. Neither Linstow nor Fuhrmann mentions the structure of the cirrus, but in the former's figure of this species there is surrounding the genital pore a large shaded area which may well represent an everted bulbous cirrus. The testes are usually arranged obliquely, but may be placed symmetrically, or even one behind the other

* Dorsally the collar bearing the spines forms a slight forwardly-directed curve, and, owing to this curvature, when excessive pressure is applied to this surface, more force is brought upon the median spine than upon any of the other marginal spines. By this means, the median spine could easily become displaced posteriorly and brought into direct alignment with the laterals of the five dorsal spines. The arrangement of these spines could then be interpreted as forming two rows, with the median and lateral spines forming the aboral or posterior row and the two remaining spines the oral or anterior row. On the other hand, it is possible that with age and growth the dorsal spines may naturally form two distinct rows. This inconstant arrangement of the dorsal spines is known in another echinostome species, *Paryphostomum radiatum* (Duj.).

(according to Linstow, the latter). They are slightly lobed or irregular in outline, and measure 0.12–0.27 mm. in length (0.18 mm.) and 0.12–0.25 mm. in width (0.45–0.73 mm.). Invariably the right or hinder testis is distinctly larger than the left or foremost. The spherical ovary measures 0.06–0.12 mm. in diameter (0.1 mm.). The vitelline follicles are relatively large, and extend from about the level of the middle of the ventral sucker to the posterior end of the body. In one specimen with tandem testes, however, the follicles extend to the anterior border of the ventral sucker. Behind the testes the follicles of both sides converge towards the median line, but are usually separated by the main stem of the excretory vesicle. The uterus is short, and contains up to 16 eggs, measuring 0.084–0.096 \times 0.056–0.061 mm. (0.088–0.095 \times 0.056–0.060 mm.).

“*Petasiger*” *megacanthus* (Kotlán, 1922). (Fig. 2.)

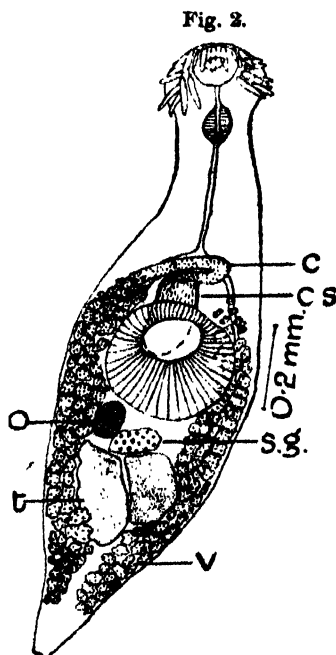
Syn : *Echinostomum pungens* of Odhner, 1910 ; *Echinostomum megacanthum* Kotlán, 1922 ; *Petasiger neocomense* Fuhrmann, 1927 ; *Petasiger nitidus* Linton, 1928.

Linton's species was recorded from a horned grebe (*Podiceps auritus*) in America, while the others mentioned above were recorded from the great crested grebe (*Podiceps cristatus*) in Europe. Apart from the arrangement of the testes, there is very little doubt that the forms described by these authors are all identical. In the species described by Fuhrmann and Linton the testes are stated to be arranged obliquely, but in Kotlán's species they are placed directly one behind the other, while Odhner does not mention the arrangement in the single specimen at his disposal*. The British Museum (Natural History) possesses four sets of specimens of this species, collected from *Podiceps cristatus* at four localities in England, and in the majority of these specimens the testes are arranged more or less obliquely, sometimes almost tandem, while in the remainder they are symmetrical. It is therefore most probable that, as in “*Petasiger*” *pungens*, the arrangement of the testes has no specific significance.

* The writer has been unable to consult the description given by Issaitschikow (Trad. Sibir. Vet. Inst. ix, 1927, 5 pp.) of *Echinostomum megacanthum* Kotlán from *Podiceps cristatus* and *Podiceps grisegena* in the Crimea.

The following are the chief characters by which "*P.*" *megacanthus* may be distinguished from "*P.*" *pungens* :—

The body is more fusiform. The difference between the lengths of the marginal and terminal spines is clearly smaller. The length of the œsophagus in relation to that of the pharynx is much greater. The cirrus-sac is distinctly muscular and more elongate. When fully everted,



"*Petasiger*" *megacanthus*; ventral view. Lettering as in fig. 1.

the cirrus is long and slender. The anterior extent of the vitelline glands is a little greater.

The more important measurements of the present specimens are indicated in the table opposite.

Of the remaining species of "*Petasiger*" from grebes, "*P.*" *lobatus* (? syn. *Echinoparyphium brevicaruda*) and "*P.*" *grandivesicularis* from *Podiceps ruficollis japonicus*, and "*P.*" *australis* from *Podiceps ruficollis novæhollandiæ* bear a strong resemblance to "*P.*" *pungens*, while "*P.*" *novemdecim* from *Podiceps dominicus* is so inadequately described that it is practically impossible to form an opinion on its relationship.

Measurements (in millimetres) of "*P.*" *megacanthus* and its synonyms.

Species	<i>Echinostomum megacanthum</i> Kotlán.	<i>Echinostomum pungens</i> of Odhner.	" <i>Petasiger</i> " <i>neocomense</i> Fuhrmann.	" <i>Petasiger</i> " <i>nitidus</i> Linton.	" <i>Petasiger</i> " <i>megacanthus</i> . Present paper.
Reference	Kotlán, 1922.	Odhner, 1910.	Fuhrmann, 1927.	Linton, 1928, Beaver, 1939.	
Length	1.6-1.78	1.5	1.56	1.26-2.25	0.9-1.6
Maximum width	0.4-0.5	—	0.47	0.42-0.7	0.3-0.45
Diameter of "head-crown"	0.34	—	0.32	0.22-0.28	0.21-0.27
Length of marginal spines	0.086-0.097	0.083	0.09-0.1	0.078-0.12	0.064-0.084
Length of terminal spines	0.11-0.12	0.08-0.097	—	0.09-0.15	0.084-0.11
Diameter of oral sucker	0.1	0.08	—	0.063-0.09	0.075-0.092
Diameter of ventral sucker	0.32	0.33	0.34	0.24-0.34	0.25-0.34
Length-ratio of oesophagus to pharynx	4:1	—	4:1	3-5:1	3-5:1
Eggs	$\left\{ \begin{array}{l} 0.097 \\ \times \\ 0.064 \end{array} \right.$	$\left\{ \begin{array}{l} 0.074-0.077 \\ \times \\ 0.052^* \end{array} \right.$	$\left\{ \begin{array}{l} 0.084 \\ \times \\ 0.045 \end{array} \right.$	$\left\{ \begin{array}{l} 0.084-0.09 \\ \times \\ 0.054-0.06 \end{array} \right.$	$\left\{ \begin{array}{l} 0.084-0.092 \\ \times \\ 0.056-0.058 \end{array} \right.$

* In the present material much-shrunken eggs measure ca. 0.07×0.04 mm.

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II.—*New or little-known Tipulidæ (Diptera).—LXXII. Neotropical Species.* By CHARLES P. ALEXANDER, Ph.D., F.R.E.S., Massachusetts State College, Amherst, Massachusetts, U.S.A.

IN the present instalment I am discussing various species of crane-flies from Ecuador that were captured by Messrs. F. Martin Brown, David Laddey and William Clarke-Macintyre, who are largely responsible for our recent great increase in knowledge of many groups of insects in this republic. My deep thanks are extended to the collectors for the privilege of retaining in my collection the types of the novelties discussed. Paratypes of the species secured by Professor Brown have been deposited in the collection of the American Museum of Natural History, New York City.

Brachypremna ara juno, sp. n.

Size medium (wing, male, 18.5 mm.); mesonotal præscutum conspicuously patterned with brown, obscure

yellow and brownish black; mediotergite dark brown with a pair of yellowish spots on the posterior third; basal flagellar segments weakly bicoloured; palpi black, the apices of the segments yellow; thoracic pleura patterned with darker; legs brownish black, the tarsi paling to obscure yellow; wings strongly infuscated, patterned with darker brown and cream-coloured areas; darkenings of abdominal sternites very pale, broadly triangular in outline; male hypopygium with the caudal margin of the ninth tergite with a broad U-shaped notch, the adjoining angles of which are produced into relatively small lobes; lateral portions of tergite on either side with about a score of strong setæ; dististyle slightly widened outwardly, its tip obtuse.

Male.—Length about 14 mm.; wing 18.5 mm.

Frontal prolongation of head obscure brownish yellow above, infuscated on ventral half; nasus blackened; palpi conspicuously variegated, the segments black with yellow apices, that of the fourth unusually extensive and conspicuous. Antennæ with scape and pedicel yellow; proximal flagellar segments weakly bicoloured, most conspicuously so on the first segment where the basal half is infuscated, the apex yellow; succeeding segments with the darkened bases less conspicuous; outer five segments uniformly brownish black. Head brownish yellow, more or less yellow pollinose; posterior vertex on either side of mid-line more or less darkened.

Pronotum chiefly dark brown, narrowly lined longitudinally with yellowish stripes. Mesonotal præscutum conspicuously patterned, the ground-colour behind obscure yellow pollinose, in front, particularly in the humeral region, strongly infuscated; disk of præscutum chiefly occupied by four brown stripes that are vaguely margined by still darker brown, the cephalic ends of the intermediate stripes brightening to obscure orange; lateral præscutal stripes broadly triangular, very wide at the suture, separated from the humeral darkening by an oblique yellowish line; scutal lobes chiefly infuscated, the median region narrowly and indistinctly paler; scutellum infuscated, a very little paler on sides, parascutella dark; mediotergite almost uniformly dark brown on its proximal two-thirds, the posterior portion with an obscure yellow oval spot on either side of the mid-line; pleurotergite

chiefly testaceous yellow, the posterior dorsal portion a little darker. Pleura with the ground-colour testaceous yellow, the propleura and mesepisternum extensively and conspicuously variegated with brown; dorsopleural membrane infuscated. Halteres brownish black, the base of the stem yellow, the knob slightly darker. Legs with coxæ obscure yellow, more or less extensively infuscated on outer faces; trochanters yellow; femora brownish black, the bases narrowly obscure yellow; tibiæ black; tarsi brownish black, the outer segments paling to obscure yellow. Wings with the ground-colour strongly infuscated, the prearcular and costal fields more intensely so; stigma oval, darker brown, slightly more blackened around the margins; wing tip and margin narrowly bordered by darker brown; restricted but conspicuous yellow spots, most evident in cells R_5 and M_1 ; veins beyond cord narrowly bordered by brown, vein Cu less evidently so; veins beyond cord brownish black, in the costal and prearcular fields more reddish brown. Venation: Rs square at origin; $r-m$ obliterated by the short fusion of R_{4+5} and M_{1+2} ; m a trifle longer than the petiole of cell M_1 .

Basal abdominal tergites dark brown, patterned with obscure yellow on margins; outer tergites more or less variegated with yellow on their basal rings; subterminal segment dark brown; sternites chiefly obscure yellow, each with a broad-triangular pale brown mark that does not reach the margins. Male hypopygium with the tergite of distinctive conformation, transverse, narrowed outwardly, the caudal margin with a broad and relatively deep U-shaped notch, the lateral borders of which are produced into relatively small, abundantly setuliferous lobes; outer portions of tergite with about a score of long powerful setæ, the extensive median area with abundant setulæ. Dististyle with the spine of outer face placed at near two-fifths the length of style, strong and powerful, short, acute at tip; apex of style flattened, slightly widened outwardly, gently curved, its tip obtuse; outer margin before apex with a few relatively short setæ.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, headwaters of the Rio Arajuno, Napo Watershed, altitude 1000 metres, April 24, 1941 (*Macintyre*).

From all other species of the genus having blackened femora and tibiæ, including *Brachypremna nigrofemorata* Alexander and *B. uniformis* Alexander, the present fly is readily told by the larger size, distinctive coloration of the body and wings, and by the pattern of the antennæ and palpi.

Brachypremna karma, sp. n.

Size above medium (wing, male, 22 mm.); head and thoracic notum uniformly dark brown, unpatterned, the thoracic pleura and pleurotergite yellow, unmarked; femora and tibiæ black, the genua broadly whitened; distal fourth of tibiæ white, tarsi white; wings with a strong brownish tinge, restrictedly patterned with darker brown; conspicuous yellowish spots before and beyond stigma, in outer medial field and at outer end of cell *M*; *Rs* square and more or less angulated at origin; abdominal tergites brown, the basal rings more yellowed; sternites uniformly yellow, without darkening; male hypopygium with the tergite transverse, its caudal margin almost truncate; dististyle uniformly pale, the tip strongly decurved, the outer margin with about eight strong setæ.

Male.—Length about 20 mm.; wing 22 mm.

Frontal prolongation of head testaceous yellow, including the long conspicuous nasus, the ventral half a trifle darker; palpi black, the incisures of the more proximal segments narrowly whitened, the terminal segment uniformly black. Antennæ with scape testaceous yellow, pedicel clearer yellow; flagellum broken. Head above brown, sparsely pollinose but virtually unpatterned, beneath clearer yellow.

Pronotum brown. Mesonotum uniformly dark brown, without pattern, the parascutella, lateral portions of mediotergite, and the pleurotergite more yellowed. Pleura uniformly yellow, unpatterned, the dorsopleural region more infuscated. Halteres with stem yellow, knob more infuscated, its apex paler. Legs with the coxæ and trochanters yellow; femora with bases rather narrowly yellowed, passing into black, the tips rather broadly (on fore leg about one-eleventh) and abruptly white; tibiæ black, the bases abruptly white, the amount a little less than the femoral tips; tips of tibiæ (about the distal fourth) whitened; tarsi white. Of three legs preserved

two are detached, but all of these are similar in colour; it is possible that the posterior legs are differently coloured. Wings with a strong brownish tinge, the prearcular and costal fields somewhat richer brown; stigma oval, yellowish brown, ringed with darker brown; veins beyond cord more or less scamed with slightly darker brown, more intense at wing-tip; conspicuous yellowish spots as follows: Before and beyond stigma; outer end of cell R_5 ; centres of cells M_1 , 1st M_2 and 2nd M_2 ; outer end of cell M and the base of M_4 , forming conspicuous paired areas on either side of $m-cu$; cell Cu somewhat paler than the remainder of ground, particularly on its basal half; veins brown. Venation: Rs square and more or less angulated at origin.

Abdomen with tergites brown, restrictedly more yellowish on sides at base or over the basal rings; sternites uniformly yellow; eighth tergite somewhat more darkened on its proximal half; hypopygium yellow, the tergal lobes infuscated. Male hypopygium with the tergite transverse, its caudal margin very shallowly emarginate to subtruncate, the lobes correspondingly low. Basistyles relatively stout. Dististyle uniformly pale; outer spinous lobe at near one-third the length of style, long and erect; spex of style strongly decurved into a flattened blade, the outer margin before apex with about eight long strong setae; apex of blade with scattered peg-like spines scattered over the surface.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, headwaters of the Rio Arajuno, Napo Watershed, altitude 1000 metres, April 29, 1941 (*Macintyre*).

Brachypremna karma is very different from all other species so far made known, particularly in the unvariegated thorax and abdomen and in the rather conspicuous pattern of the wings, especially the yellow areas on the otherwise infuscated ground. By existing keys the fly runs to *B. candida* Alexander but is entirely distinct.

**Tipula* (*Eumicrotipula*) *chicana*, sp. n.

Belongs to the *glaphyroptera* group; size small (wing 12 mm. or less); general coloration buffy grey, the præscutum and scutum heavily patterned with dark brown or black; antennæ black, the pedicel obscure yellow; legs uniformly blackened; wings cream-yellow, very heavily

patterned with brown, restricting the ground-colour to large spots in most of the cells; R_{1+2} entirely atrophied; abdomen black, more or less pruinose, especially the basal tergite and the posterior borders of the succeeding segments; male hypopygium with the ventrocaudal lobe of basistyle short-oval; outer dististyle small, cylindrical; gonapophyses lobed at apex; eighth sternite unarmed.

Male.—Length about 8.5–9 mm.; wing 11.5–12 mm.; antenna about 3.8–4 mm.

Female.—Length about 9 mm.; wing 11 mm.

Frontal prolongation of head black, sparsely pruinose; nasus long and conspicuous; palpi black. Antennæ of moderate length, black, the pedicel obscure yellow; flagellar segments only moderately incised; verticils shorter than the segments. Head infuscated, the front and orbits somewhat paler, more buffy grey; summit of vertical tubercle with a small, more blackened spot.

Pronotum black, sparsely pruinose. Mesonotal præscutum with the ground-colour yellow or greyish yellow, heavily striped with dark brown; median stripe very broad, its lateral borders and a central vitta more intensely black; all præscutal stripes reaching the suture behind; scutal lobes extensively dark brown, the median area a little paler, the sides greyish yellow; scutellum grey pruinose, parascutella blackened; postnotum pruinose, the central portion of mediotergite darkened. Pleura light grey, heavily patterned with dark brown on the anepisternum, ventral sternopleurite, meron and lower pleurotergite. Halteres with stem yellow, knob darkened. Legs with coxæ grey pruinose; trochanters dark brown; remainder of legs uniformly black, without femoral brightening. Wings with the ground-colour cream-yellow, very heavily patterned with brown, restricting the ground to large spots in most of the cells, all the dark areas interconnected across the wing and along the veins: veins brownish black. Venation: R_3 nearly twice $m-cu$; R_{1+2} entirely atrophied; petiole of cell M , subequal to or longer than m .

Abdomen black, more or less pruinose, especially the basal tergite and the posterior borders of the succeeding segments; sternites and hypopygium blackened, the surface weakly pruinose. Male hypopygium with the caudal border of tergite almost straight, with a very small

U-shaped median notch, the sides of which are very slightly produced. Basistyle with the ventro-caudal lobe short-oval, with conspicuous setiferous tubercles. Outer dististyle small, cylindrical, only a little over one-third the length of the inner style. Gonapophyses toothed or lobed at apex. Eighth sternite with the caudal margin evenly and convexly rounded, entirely unarmed, the discal setae very sparse and scattered.

Hab. Ecaudor (Tungurahua).

Holotype, ♂, Tungurahua, Minza Chica, altitude 3500 metres, April 4, 1939 (*Brown*). *Allotype*, ♀, pinned with type. *Paratopotypes*, 6 ♂ ♀, April 4-13, 1939 (*Brown*).

Tipula (*Eumicrotipula*) *chicana* is readily told from other regional species of the *glaphyoptera* group that have the wings heavily patterned and vein R_{1+2} atrophied by the small size and uniformly blackened legs. The structure of the male hypopygium is likewise distinctive, particularly the tergite, gonapophyses and the unarmed eighth sternite. The most similar of these other species are *T. (E.) consonata* Alexander, *T. (E.) fraudulenta* Alexander, and *T. (E.) obirata* Alexander.

Tipula (*Eumicrotipula*) *efficax*, sp. n.

Belongs to the *glaphyoptera* group; mesonotum obscure brownish yellow, patterned with brownish black to black, including three black præscutal stripes; antennae relatively short, scape and pedicel yellow, flagellum abruptly black; flagellar segments scarcely incised; knobs of halteres brownish black; wings infuscated, the costal region with four extensive but ill-delimited darker brown clouds, the interspaces obscure yellow; R_{1+2} atrophied; first abdominal tergite yellow, succeeding tergites brown; basal sternites yellow, the outer segments infuscated; male hypopygium with the caudal margin of tergite gently emarginate, with a rounded median notch; outer dististyle cylindrical; eighth sternite unarmed.

Male.—Length about 11 mm.; wing 13 mm.; antenna about 2.8 mm.

Frontal prolongation of head relatively short, yellow; nasus short and stout, tufted with long black setae; palpi black. Antennae relatively short; scape and pedicel yellow, flagellum abruptly black; flagellar segments nearly cylindrical, the basal enlargement not or scarcely

indicated; verticils unusually short, less than the segments; segments clothed with a very short dense white pubescence; antennæ 12-segmented, the usual reduced terminal segment fused with the penultimate. Head obscure buffy yellow in front, more brownish grey behind; anterior vertex approximately three times as wide as the diameter of scape.

Mesonotal præscutum obscure brownish yellow, with three brownish black stripes, entire and well-separated by the ground interspaces, the median stripe weakly divided by a paler line, its posterior end more reddened; scutum brownish black; scutellum testaceous brown, the parascutella slightly darker; postnotum, including the pleurotergite, brownish black. Pleura chiefly obscure yellow, vaguely patterned by pale brown, especially on the metapleura and meron. Halteres relatively long, stem yellow, darkened outwardly, the knob brownish black. Legs with the coxæ and trochanters obscure yellow; remainder of legs broken. Wings with the ground-colour strongly infuscated, the costal border with four further darkened areas that are relatively ill-delimited, merging behind with the ground and likewise with the more obscure yellow interspaces; the darkened costal areas extend more or less distinctly across the basal cells to vein *Cu*, the postarcu. r darkening being particularly evident; a more or less distinct suffusion along the cord; cells *R*, *M*, outer radial cells and bases of anal cells vaguely brightened; veins dark brown. Venation: R_{1+2} atrophied; *Rs* about twice *m-cu*; petiole of cell M_1 a little exceeding *m*.

First abdominal tergite light yellow, contrasting with the black postnotum; succeeding tergites brown, their caudal borders somewhat paler, the lateral borders of the basal two tergites narrowly but conspicuously black; basal sternites yellow, the outer segments infuscated. Male hypopygium with the caudal margin of the tergite gently emarginate, with a further rounded U-shaped median notch, the adjacent angles produced into short acute points. Basistyle unarmed. Outer dististyle cylindrical, dark-coloured, provided with long coarse setæ. Inner dististyle longer than the outer, more or less leg-shaped, the "foot" compressed, obtuse at its tip. Eighth sternite unarmed.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Rio Blanco, Pastaza, altitude 2000 metres, May 1940 (*Macintyre*).

Tipula (*Eumicrotipula*) *efficax* is entirely distinct from the other regional members of the group having patterned wings and veins R_{1+2} atrophied. The relatively heavy yet diffuse costal pattern, in conjunction with the short simple antennæ and the structure of the male hypopygium, readily serve to separate the fly from other generally similar species, as *T. (E.) chicana*, sp. n., *T. (E.) fraudulenta* Alexander, and others.

Tipula (*Eumicrotipula*) *phalangoides*, sp. n.

Almost apterous in both sexes; general coloration brown and yellow, with pruinose areas; antennæ short, flagellar segments cylindrical or virtually so, with sparse appressed verticils on the outer segments; legs long, brown, femora with a vague, obscure yellow, subterminal ring; abdominal tergites buffy to orange, broadly blackened medially.

Male.—Length about 9–10 mm.; wing 0.6–0.7 mm.; antenna about 2.3–2.4 mm.

Female.—Length about 11–12 mm.; wing 0.6–0.7 mm.

Frontal prolongation of head brown; nasus distinct; palpi black. Antennæ short, or a little longer than the palpi; scape and pedicel yellow, flagellum black; antennæ 11- or 12-segmented; flagellar segments short-cylindrical, the intermediate segments transversely furrowed and wrinkled; a very short dense black pubescence; outer segments with sparse appressed verticils. Head reddish brown, variegated with darker brown on anterior vertex and as a more or less distinct median line; sides of anterior vertex and the occipital region more pruinose; vertical tubercle low and inconspicuous, entire.

Pronotum reddish brown. Mesonotal præscutum reddish brown, variegated by dark brown or brownish black on sides, the præscutum more or less light grey pruinose; posterior sclerites of notum orange-yellow to obscure yellow medially, the surface more or less pruinose, the sclerites darker laterally; scutum and scutellum somewhat darkened medially, the postnotum clear yellow. Pleura dark brown. Both pleura and tergum greatly modified by the nearly apterous condition, the præscutum being almost flat; scutellum not projecting; pleura very

narrow and reduced, the coxæ correspondingly lengthened. Halteres brown, of moderate length but twisted, the knobs very long in comparison with the length of the stems. Legs with coxæ dark brown basally, paling to obscure yellow on outer half; trochanters brown; femora brown, the tips more brownish black, preceded by a vague, obscure yellow, subterminal ring; remainder of legs dark brown, the tibiae and basitarsi a trifle paler; legs long and slender in relation to the body; claws simple, long and almost straight. Wings reduced to tiny pads in both sexes, approximately one-half the length of the halteres; basal half somewhat paler than the distal portion; no distinct venation other than a greatly thickened costa.

Basal abdominal tergites pale buffy to orange, conspicuously patterned with black, including broad lateral borders and lateral triangles and short median lines that are broken at the posterior borders of the segments; surface more or less grey pruinose, especially near posterior portions of segments; setigerous punctures of the pale ground sparse but conspicuous, black; sternites more orange, the caudal margins darker brown; outer segments, including hypopygium, brownish black. In the female the tergites are more broadly blackened laterally, leaving a broad pale median stripe. Ovipositor with valves long and slender, especially the needle-like cerci. Male hypopygium of moderate size. Ninth tergite with its caudal margin generally convex but produced into two short submedian lobes that are separated by a U-shaped notch. Outer dististyle a spatulate blade. Inner dististyle elongate, blackened, bifid near apex. Eighth sternite unarmed.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Minza Chica, Mount Tungurahua, altitude 3900 metres, April 11, 1939 (*Brown*). *Allotopotype*, ♀, pinned with type. *Paratopotypes*, 40 ♂♀, altitude 3900–4650 metres (12,675–15,112 feet), April 10–11, 1939 (*Brown*).

This is one of the most interesting crane-flies secured by Professor and Mrs. Brown in Ecuador. It is readily told from all other described species of the subgenus by the diagnostic features listed above, particularly the greatly reduced wings of both sexes. The antennal verticils are so reduced that I had at first placed this fly in the genus

Holorusia Loew, but from the structure of the male hypopygium there can be no question of the correctness of the present assignment.

The following notes on the occurrence of this high-altitude species were supplied by Professor Brown. "These flies were taken between 4000 and 4650 metres on Minza Ridge (S.E.), Volcan Tungurahua, while running about over the ground. One female was ovipositing in wet moss. A copulating pair was preserved in alcohol. No sun during the day—hail, sleet and rain, plus mist, all of the time. The highest specimen was taken at the foot of the cliffs of the west crater, which was also the highest point at which we observed moss." "These specimens (27, chiefly males) are from the lower slopes of Minza Ridge just above and among the last of the heaths, the latter about six inches high. These specimens represent the lowest altitude at which the species was found." There is a brief further note by Professor Brown in an article by W. Robert Moore, "From sea to clouds in Ecuador," *Nat. Geog. Mag.*, 80: 724; December 1941.

Limonia (Neolimnobia) orthogonia, sp. n.

Size small (wing, male, 5.5 mm.); general coloration yellow, the præscutum with a median dark stripe; scutum and scutellum with double dark stripes that enclose a pale central line; antennal flagellum brown; legs black, the femora with two yellow rings, the outermost apical; wings yellow, patterned with brown; *Rs* square and short-spurred at origin; a supernumerary cross-vein in cell *R*₅ just beyond the level of vein *R*₂; abdomen yellow, the posterior borders of the tergites narrowly dark brown; male hypopygium with the rostral prolongation of the ventral dististyle long and slender, with two relatively long curved spines arising from a common tubercle.

Male.—Length about 5 mm.; wing 5.5 mm.

Rostrum brownish black; palpi black. Antennæ with scape obscure yellow; pedicel brownish yellow; flagellum brown; basal flagellar segments subglobular, the outer ones more elongate, especially the terminal segment which is one-third longer than the penultimate; verticils of the more basal flagellar segments very long, the longest ones more or less unilaterally distributed. Head light fulvous or brownish yellow, the anterior vertex more greyish, of

moderate width, approximately twice the diameter of the scape.

Pronotum dark brown above, yellow on sides. Mesonotum yellow, the præscutum with a relatively narrow but conspicuous dark brown median stripe, at the suture divided, including the mesal edges of the scutal lobes and lateral portions of the scutellum, converging behind, enclosing a pale central stripe on the two latter sclerites; central portion of mediotergite chiefly darkened, the lateral borders and all of the pleura and pleurotergite pale yellow. Halteres with stem obscure yellow, knob brownish black. Legs with the coxæ yellow; trochanters more greenish yellow; a single leg (hind) remains; femora black, the narrow apex and a wider subterminal ring yellow, enclosing a black annulus that is approximately twice as extensive as the yellow tip; femoral bases restrictedly obscure yellow; tibiæ and tarsi uniformly black. Wings with a strong yellow tinge, the prearcular and costal portions more saturated yellow; a conspicuous brown pattern that is restricted to the vicinity of the veins, including areas at arculus; origin of R_s and fork of Sc ; R_2 and free tip of Sc_2 ; cord and outer end of cell 1st M_2 , and over the supernumerary cross-vein in cell R_3 ; less distinct seams along the veins beyond cord, Cu , 1st A and 2nd A ; outer end of cell Sc_2 more or less clouded with brown; veins dark brown, greenish yellow in the costal field. Venation: Sc short, Sc_1 ending about opposite the origin of R_s , Sc_2 at its tip; R_s square and short-spurred at origin; a supernumerary cross-vein in cell R_2 , just beyond level of R_2 ; $m-cu$ at or shortly before fork of M . In the unique type, a further adventitious cross-vein in cell R_3 , lying at about two-thirds the length of the cell.

Abdomen yellow, the posterior borders of tergites narrowly dark brown, becoming less distinct to sub-obsolete on the eighth and ninth segments; hypopygium yellow. Male hypopygium with the caudal border of tergite strongly convex. Basistyle with ventral-mesal lobe obtuse; face of style just cephalad of lobe with a few stronger blackened bristles, those of the lobe long and delicate. Dorsal dististyle straight on basal half or more, thence curved, the tip acute. Ventral dististyle relatively large and fleshy, its area a little greater than that of basistyle; rostral prolongation long and slender, with two

curved spines from a common tubercle; spines relatively long, exceeding in length the slender apex of the prolongation beyond them. Gonapophyses with mesal-apical lobe long and only gently curved.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, Abitugua, altitude 1100 metres, March 21, 1940 (*Macintyre*).

The present fly differs conspicuously from the two other small species having a supernumerary cross-vein in cell R_3 that have been tentatively assigned to this subgenus. It differs from *Limonia* (*Neolimnobia*) *interstitialis* Alexander in the small size and patterned legs, and from *L.* (*N.*) *paprzyckii* Alexander in the venation and in the structure of the male hypopygium. It should be noted that these various species are evidently allied to other species in the Neotropical fauna that lack the supernumerary cross-vein in cell R_3 and are therefore placed in the typical subgenus *Limonia*, such flies including *L.* (*L.*) *contradistincta* Alexander, *L.* (*L.*) *melanantha* Alexander, *L.* (*L.*) *meridensis* Alexander and *L.* (*L.*) *repanda* Alexander.

Limonia (*Peripheroptera*) *peramaena*, sp. n.

General coloration black, the mesonotum variegated with yellow pollen, including the præscutal interspaces; antennæ black throughout; thoracic pleura heavily grey pruinose, variegated by more blackened areas; legs black, the femoral bases restrictedly obscure yellow; wings yellow, conspicuously patterned with brown, this including the wing-tip, a broad seam at cord, and less evident areas elsewhere; abdomen black, the caudal borders of the segments vaguely paler.

Female.—Length about 7.5 mm.; wing 9 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments oval, the more basal segments shorter. Head black.

Pronotum black. Mesonotal præscutum with the restricted ground obscure brownish yellow pollinose, almost obliterated by the three extensive polished black stripes, the humeral and sublateral portions of the sclerite somewhat more conspicuously brownish yellow pollinose, the lateral border blackened; scutum black; posterior sclerites of notum black with a sparse golden-yellow pollen on the central portions. Pleura heavily clear grey

pruinose, variegated by more blackish areas on the ventral anopisternum and the ventral sternopleurite. Halteres black, the extreme base of stem paler. Legs black, with only the narrow femoral bases obscure yellow. Wings with the ground-colour yellow, patterned with brown as follows: a conspicuous band across cord, extending from the stigma to the caudal border opposite vein *Cu*; outer end of cell 1st M_2 ; a restricted postarcular darkening in the bases of cells *R* and *M*; a conspicuous cloud at Sc_2 ; wing-tip broadly infuscated, somewhat more intensely so in cell R_3 ; less evident brown washes along the posterior border of wing, including much of cell 2nd *A*, veins brown, those in the prearcular field more brownish yellow. Venation: Sc_1 ending opposite origin of *Rs*, Sc_2 far from its tip; *Rs* very gently arcuated, a little longer than the basal section of R_{4+5} ; free tip of Sc_2 and R_2 virtually in transverse alignment, with R_{1+2} jutting beyond as a short spur; cell 1st M_2 elongate, nearly equal to vein M_{1+2} beyond it; *m-cu* about one-fourth its length beyond fork of *M*; cell 2nd *A* moderately broad, widest about opposite two-thirds the length.

Abdomen black, the caudal margins of the tergites very narrowly and insensibly paler brown; genital shield black; valves of ovipositor reddish horn-colour, the bases of the cerci blackened.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Minza Chica, Mount Tungurahua, altitude 3200 metres April 8, 1939 (*Brown*).

Closest to *Limonia* (*Peripheroptera*) *angustifasciata* (Alexander), of Venezuela, differing in the details of coloration, especially of the thoracic notum, pleura and abdomen.

Limonia (*Geranomyia*) *beatrice*, sp. n.

Allied to *glauca*; mesonotal præscutum with the central dark stripe relatively narrow; anterior vertex (male) unusually narrow, the eyes correspondingly large; pleura and pleurotergite uniformly pale yellow; knobs of halteres blackened; femora chiefly blackened, the outer third or fourth yellow, enclosing a conspicuous black ring; wings pale yellow with a showy brown pattern that is chiefly marginal in distribution; third costal area involving both the fork of *Sc* and the origin of *Rs*; Sc_1 ending about

opposite two-fifths the length of *Rs*; abdomen brownish yellow; male hypopygium with the rostral prolongation of the ventral dististyle relatively stout; gonapophyses with mesal-apical lobe darkened, appearing more or less shell-like in outline, terminating in a small apiculate point; anal tube very low and broad, with a few strong setæ.

Male.—Length, excluding rostrum, about 7.5 mm.; wing 7.4 mm.; rostrum about 3.5 mm.

Rostrum, including maxillary palpi, black. Antennæ black throughout; flagellar segments long-oval, with relatively short verticils; terminal segment about one-third longer than the penultimate. Head with eyes large, the anterior vertex reduced to a mere strip that is about as wide as a single row of ommatidia; grey, on posterior vertex becoming wider and bordered on either side by blackish areas.

Pronotum narrowly darkened medially, paler on sides. Mesonotal præscutum yellow, with three cinnamon-brown stripes, the central one darker medially, paling on the edges; this stripe is narrower than in *glauca* but wider than in *anthina*, not bordered laterally by a silvery line, as in *glauca*; lateral præscutal borders not or scarcely darkened; scutal lobes with conspicuous dark brown areas, the central portion yellow; scutellum grey basally, bordered on either side and behind by blackish, parascutella yellow; mediotergite blackened medially, the lateral borders broadly yellow; pleurotergite uniformly pale yellow. Pleura, including the dorsopleural membrane, yellow. Halteres relatively short, stem yellow, more obscure outwardly, the large knob blackened. Legs with coxæ and trochanters greenish yellow; femora yellow on about the basal third or fourth, thence passing into dark brown or brownish black, the distal third or fourth yellow, enclosing a clearly defined black ring that is about equal in extent to either subtending pale band; tibiæ brown, paler basally; tarsi somewhat paler than tibiæ, the outer segments brownish black. Wings pale yellow, with a conspicuous and handsome brown pattern that is chiefly marginal in distribution, including four costal areas, the third extensive and irregular, involving both the fork of *Rs* and the origin of *Rs*; fourth area stigmal, confluent with a

conspicuous seam across cord, broken just before $r-m$; outer end of cell 1st M_2 seamed with brown; conspicuous marginal brown seams, smallest on M_{1+2} ; areas on veins R_3 and R_{4+5} extending back along the veins and becoming confluent near outer end of cell R_3 ; seam on vein M_3 involving the entire vein; seams on anal veins of moderate size but well defined; a distinct seam at near mid-length of vein Cu in cell M ; veins yellow, brown in the clouded areas. Venation: Sc relatively long, Sc_1 ending about opposite two fifths the length of Rs , Sc_2 at its tip; Rs angulated to virtually square at origin; cell 1st M_2 long, subequal to the distal section of vein M_{1+2} ; $m-cu$ a short distance beyond fork of M , shorter than the distal section of Cu_1 ; vein 2nd A straight for most of its length, the cell relatively narrow.

Abdomen obscure brownish yellow; hypopygium clearer yellow. Male hypopygium with the ninth tergite transverse, narrowed outwardly, the caudal margin very shallowly emarginate, with correspondingly low lobes that are provided with strong setæ. Basistyle small, its area only about one-fourth that of the ventral dististyle; ventromesal lobe simple. Dorsal dististyle a moderately curved rod, its tip acute. Ventral dististyle large and fleshy, the rostral prolongation small but stout, bearing two separate long spines from basal tubercles. End of anal tube very low and broad with few but very strong setæ. Gonapophyses with mesal-apical lobe darkened, appearing more or less shell like in outline, terminating in a small apiculate point. Ædeagus terminating in two divergent flaps.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, Abitagua, altitude 1200 metres, August 15, 1937 (*Macintyre*).

Although related to *Limonia* (*Geranomyia*) *glauca* (Alexander), the present fly is quite distinct. In the former species, the central præscutal stripe is much broader, more fulvous, subtended on either side by a narrow silvery line, best indicated when viewed from above, while the lateral præscutal margins are darkened. The leg pattern and structure of the male hypopygium, particularly the rostral prolongation and gonapophyses, are distinct in the two flies.

Orimarga (Orimarga) trispinigera, sp. n.

Size relatively small (wing, male, under 5 mm.) ; general coloration black, the lateral margin of præscutum and a longitudinal stripe on the thoracic pleura more pruinose ; halteres uniformly blackened ; wings moderately tinged with blackish, the prearcular field more whitened ; *Sc* short, *Sc*₂ nearly opposite the origin of *Rs* ; basal section of *R*₄₊₅ strongly angulated ; male hypopygium with the dististyles fused basally, the outer one a flattened black blade, its tip suddenly narrowed into a gently curved black spine ; inner style a little longer, the slender distal portion at apex with three strong black spines.

Male.—Length about 5.5 mm. ; wing 4.8 mm.

Rostrum and palpi black. Antennæ black throughout ; flagellar segments oval, the two outer segments subequal. Head black.

Pronotum dull black. Mesonotum dull black, the surface sparsely pruinose, the lateral præscutal border narrowly light grey. Pleura dull black with a relatively indistinct and poorly delimited grey stripe across the dorsal sternopleurite and meral region. Halteres relatively long, uniformly blackened. Legs with the fore coxæ blackened, the remaining coxæ and all trochanters more brownish yellow ; remainder of legs broken. Wings moderately tinged with blackish, the prearcular field more whitened ; veins dark brown. Macrotrichia on veins beyond cord with the exception of *Cu*. Venation : *Sc* short, *Sc*₁ ending about opposite one-fifth the length of *Rs*, *Sc*₂ opposite the origin of the latter ; *Rs* angulated and short-spurred at origin ; free tip of *Sc*₂ far before *R*₂, *R*₁ alone subequal to *R*₁₊₂ ; *R*₃₊₄ about one-half longer than *R*₂ ; basal section of *R*₄₊₅ strongly angulated ; cell *M*₂ narrowed ; cell *M*₃ longer than its petiole ; *m-cu* about opposite one-third the length of *Rs* ; cell 2nd *A* narrowed on its distal portion.

Abdominal tergites black, the sternites a little paler ; hypopygium black. Male hypopygium with a low swelling on mesal face of basistyle near its proximal end, this provided with numerous long erect setæ. Both dististyles of unusual and distinctive conformation, united at their bases ; outer style shorter, appearing as a relatively flattened blade, its tip suddenly narrowed into a gently curved black spine ; inner style longer, its basal half

stout, provided with numerous setæ, about six or seven near base long and very slender, the outer ones shorter and stouter; at near mid-length of free portion of style it becomes more narrowed, on outer margin at and back from apex with three black spinous setæ; lower margin of style with a scattered row of strong setæ, those near apex somewhat shorter.

Hab. Ecuador (Santiago-Zamora).

Holotype, ♂, Zamora, altitude 1000 metres, October 15, 1941 (*Laddey*).

Although the wings of the present fly are much less darkened, it seems to be most nearly allied to various black-winged species of the subgenus, including *Orimarga* (*Orimarga*) *funerula* Alexander, *O. (O.) saturnina* Alexander, and *O. (O.) scabriseta* Alexander. It is readily told from all approximately similar forms by the very different conformation of the dististyles of the male hypopygium, particularly the trispinous inner dististyle.

Polymera (Polymerodes) minutissima, sp. n.

Size very small (wing, male, 2.6 mm.); mesonotum dark brown, the pleura somewhat paler, with a brownish black dorsal longitudinal stripe; antennæ (male) elongate, exceeding the wing in length, uniformly blackened; flagellar segments weakly binodose; legs black; wings with an almost uniform brown suffusion; *Sc* unusually short, *Sc*₁ ending opposite mid-length of *Rs*, *Sc*₂ at its tip; *m-cu* before fork of *M*.

Male.—Length about 2.3 mm.; wing 2.6 mm.; antennæ about 3 mm.

Rostrum and palpi brown. Antennæ (male) elongate, exceeding in length the body or wing, black throughout; flagellar segments rather weakly binodose, the nodes with very long, outspreading verticils that are considerably longer than the segments. Head brown.

Mesonotum dark brown. Pleura brown, with a more brownish black dorsal longitudinal stripe. Halteres dusky. Legs with the coxæ and trochanters brownish testaceous; remainder of legs black (terminal tarsal segments of all legs broken). Wings with an almost uniform brownish suffusion, the costal border a trifle darker; veins brown. Venation: *Sc* unusually short, *Sc*₁ ending opposite mid-length of *Rs*, *Sc*₂ at its tip; *Rs* long,

strongly arcuated at extreme origin; R_{2+3+4} about one-third to one-half longer than R_{1+2} ; cell M_3 relatively small, the enclosing veins divergent; $m-cu$ before fork of M .

Abdomen black, the hypopygium a very little brightened.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, headwaters of the Rio Arajuno, Napo Watershed, altitude 1000 metres, April 23, 1941 (*Macintyre*).

The present fly is by far the smallest species so far discovered in the entire genus. By my key to the species of the subgenus *Polymerodes* Alexander (Can. Ent., 52: 143; 1920), it runs to *Polymera* (*Polymerodes*) *conjunctoides* Alexander, a larger and quite different fly.

Atarba (*Atarba*) *diacantha*, sp. n.

General coloration reddish yellow, the notum without pattern; antennæ (male) relatively long, about one-half the length of body; basal flagellar segments bicoloured, the proximal ends yellow, the outer portions black; each flagellar segment with a single, very powerful bristle, these unilaterally distributed; knobs of halteres darkened; legs yellow, the outer tarsal segments blackened; wings with a strong yellow tinge, stigma scarcely indicated; Sc_1 ending before origin of the very short Rs ; abdomen of male with tergites weakly bicoloured, segments seven and eight uniformly brownish black; male hypopygium with outer dististyle bearing about five or six appressed spines; appendage of ninth sternite produced into strong slender spines, one at each outer lateral angle of the plate, directed laterad.

Male.—Length about 6.5 mm.; wing 6.2 mm.; antennæ about 3.3 mm.

Rostrum obscure brownish yellow; basal segments of palpi obscure yellow, the outer two segments slightly darker. Antennæ relatively long, about one-half the length of body; scape and pedicel yellow; basal flagellar segments bicoloured, the proximal third or more yellow, the outer portion black; on the succeeding segments the amount of yellow lessens progressively, on the outer segments quite lacking; flagellar segments subcylindrical, clothed with an abundant erect pale pubescence from

conspicuous basal tubercles; each segment with a single powerful bristle, on the more proximal segments these being placed beyond mid-length, on the outer segments placed on basal half, these strong setæ unilaterally distributed. Head buffy grey; anterior vertex less than twice the diameter of the scape.

Pronotum and mesonotum reddish yellow, without markings; præscutal interspaces with a single row of four or five strong black setæ. Pleura weakly more darkened. Halteres with stem whitened, knob infuscated. Legs with coxæ reddish yellow; trochanters yellow; remainder of legs yellow, the tips of femora not or scarcely darkened; outer tarsal segments blackened. Wings with a strong yellow tinge, the prearcular and costal fields clearer yellow; stigma scarcely indicated; veins yellow, brighter in the more flavous portions. Venation: Sc_1 ending a short distance before origin of R_s , Sc_2 a short distance before its tip; R_s very short, subequal to basal section of R_5 , weakly angulated; $m-cu$ a short distance beyond fork of M .

Abdominal tergites very slightly bicoloured, the bases of the segments yellow, the broader outer portions weakly infuscated: in male a brownish black subterminal ring, involving segments seven and eight; hypopygium yellow. Male hypopygium with the outer dististyle shorter than the inner, its outer margin with five or six relatively inconspicuous and more or less appressed spines, additional to the short, curved apex; style generally parallel-sided or even gently constricted at near mid-length. Inner dististyle a slender, gently curved, blackened rod. Appendage of ninth sternite quadrate, slightly longer than wide, each outer lateral angle produced directly laterad into a slender sclerotized spine, the tip acute; surface of appendage with abundant setæ, those of the basal portion long and conspicuous, virtually as long as the appendage itself.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, Abitagua, altitude 1100 metres, September 1, 1939 (*Macintyre*).

Atarba (*Atarba*) *diacantha* is entirely distinct from the other regional species, particularly as regards the structure of the male hypopygium, as the appendage of the ninth sternite. Many species of the genus have this plate moderately produced into spinous points but none has the modification so accentuated as in the present fly.

Atarba (Atarba) tetracantha, sp. n.

General coloration reddish yellow, unpatterned; antennæ (male) nearly as long as the body or wing; proximal flagellar segments black, with very narrow yellow bases and even narrower pale tips; wings brownish yellow, stigma oval, medium brown; Sc_1 ending about opposite the origin of R_s ; male hypopygium with the broad sternal plate produced into two very conspicuous horns that are directed laterad and caudad, each bearing a strong lateral spine on its outer margin; outer dististyle slender, with scattered black spines, including three on the ventral surface; gonapophyses terminating on a smooth-margined flattened blade, without denticles.

Male.—Length about 6 mm.; antenna about 5.5 mm.

Rostrum yellow; palpi black. Antennæ (male) elongate, only a little shorter than the body or wing; scape and pedicel yellow; basal flagellar segments bicoloured, black, with the very narrow bases pale yellow, the pale colour most extensive on flagellar segments two and three where about one-eighth of the segment is brightened; in addition, the extreme apex of the adjoining segment is similarly pale; on and after the sixth flagellar segment the colour becomes uniformly black; flagellar segments very long-cylindrical; segments each with a single elongate seta before apex, these unilaterally arranged, each being about one-third as long as the segment; on the more proximal segments occur additional shorter black verticils; all segments with a further erect yellow vestiture, the longest being about one-half the longest verticils. Head pale brown, sparsely pruinose; eyes large, the anterior vertex a little less than twice the diameter of scape.

Pronotum pale brownish yellow. Mesonotum reddish yellow, unpatterned; scutellum more yellowish. Pleura brownish yellow. Halteres with stem yellow, knob infuscated. Legs with the coxæ and trochanters yellow; remainder of legs broken. Wings brownish yellow, the prearcular and costal fields clear yellow; stigma oval, medium brown; veins pale brown, those of the proximal half of wing clearer yellow. Venation: Sc_1 ending about opposite origin of R_s , Sc_2 a short distance from its tip; R_s pale, especially on proximal portion, about twice the basal section of R_5 ; cell 1st M_2 rectangular, m short; $m-cu$ about one-fourth its length beyond the fork of M .

Abdominal tergites brownish black, the incisures of the more proximal segments narrowly brightened; basal sternites yellow, more obscured on outer segments; segments seven and eight blackened to form a conspicuous subterminal ring; hypopygium yellow, the sternal plate more infuscated except medially. Male hypopygium with the broad sternal plate produced into two very conspicuous horns that diverge from one another at a strong angle, on outer margin of each with a smaller spine at near two-thirds the length; caudal margin of plate between the horns strongly emarginate, the central portion with pale membrane; dorsal portion of plate with scattered strong setæ, with smaller setæ and setulæ far out on to the horns. Outer dististyle relatively slender, entirely blackened; slightly constricted beyond base; tip short, decurved; outer margin before tip with four spines, the outermost tiny, lying far distad; lower surface of style with three elongate, erect, black spines, one subbasal in position. Inner dististyle slender, only gently curved, its tip obtuse. Gonapophyses appearing as flattened blades, the apex a smooth-margined narrow spatula with the tip obtuse. *Ædeagus* relatively small but stout at base.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, Abitagua, altitude 1200 metres, May 25, 1939 (*Macintyre*).

Atarba (*Atarba*) *tetracantha* has the male hypopygium, especially the sternal plate, somewhat as in *A. (A.) macracantha* Alexander and *A. (A.) procericornis* Alexander, but in all regards it is a quite different species. These three flies have the sternal plate unusually powerful and with a striking development of the lateral horns.

Teucholabis (*Teucholabis*) *subrubriceps*, sp. n.

Allied to *rubriceps*; general coloration orange or orange-yellow, including the head and thorax, the præscutum with a polished blackened oval area on either side; halteres blackened, the apex of knob obscure yellow; wings whitish hyaline, unpatterned except for the unusually narrow dark stigma; no darkening in vicinity of areculus; abdominal tergites black, the posterior borders broadly yellow; male hypopygium with the lobe of the basistyle long and conspicuous, terminating in a long black spine, the mesal margin with a few scattered acute spines and a

dense fringe of setæ; outer dististyle a long slender darkened rod.

Male.—Length about 7 mm.; wing 6 mm.

Rostrum yellowish brown, relatively long, approximately one-half as long as remainder of head; palpi black. Antennæ with scape and pedicel dark brown; flagellum dark brown, the segments oval. Head polished orange or orange-yellow.

Thorax orange, very restrictedly patterned with black, including a polished oval area on præscutum behind the pseudosutural foveæ and not quite reaching the lateral borders of the sclerite. Pleura reddish yellow. Halteres blackened, the extreme base of stem paler, the apex of knob obscure yellow. Legs with coxæ and trochanters reddish yellow; remainder of legs broken. Wings whitish hyaline, without dark colour excepting the unusually narrow, dark brown stigma which appears as an elongate-triangular area at the free tip of Sc_2 and R_2 ; prearcular field entirely undarkened; veins dark brown, C , Sc , R and prearcular veins more yellowed. Venation: Sc_1 ending just beyond one-fourth the length of R_s , Sc_2 some distance from its tip, just beyond the origin of R_s ; R_2 shortly beyond fork of R_s ; $m-cu$ about one-third to one-fourth its length before fork of M .

Abdominal tergites with the posterior borders broadly yellow, the bases polished black; sternites more uniformly yellow; hypopygium brownish yellow. Sternal pocket of male well-developed on both fifth and sixth segments. Male hypopygium with the lobe of basistyle long and conspicuous, blackened, terminating in a long straight black spine, the mesal margin with a few scattered appressed acute spines; along the mesal edge of lobe with a dense fringe of long setæ. Outer dististyle a long slender darkened rod, the tip broken in the unique type; the part remaining exceeds in length the lobe of the basistyle, its surface provided with numerous scattered setæ from raised tubercles. Inner dististyle terminating in a single strong blackened point. Aedeagus obtuse, badly folded in the type slide but evidently not as produced as in *rubriceps*, provided with about seven long strong setæ.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, Abitagua, altitude 1100 metres, April 12, 1940 (*Macintyre*).

Teucholabis (*Teucholabis*) *subgrubriceps* is closest to *T.* (*T.*) *rubriceps* Alexander, of south-eastern Brazil, differing in several features of coloration and in the structure of the male hypopygium. The wings are unusually clear, with the stigmal darkening greatly reduced in area, and with no darkening at arculus.

Teucholabis (*Teucholabis*) *inepta bisetosa*, subsp. n.

Male.—Length about 5.5 mm. ; wing 6 mm.

Very similar to the typical form (Peru: Huanuco), differing in slight details of the male hypopygium. Inner dististyle with its outer arm more powerful and widely separated from the inner arm, gradually narrowed to a blackened point, on the outer margin near base of the darkened portion with two strong setae. In typical *inepta*, the outer arm is more delicate and bears a single seta, beyond which point the arm narrows more abruptly into the long apical spine. Both the typical form and the present race have the setae of the expanded blade of the phallosome much more numerous than in *idiophallus*, there being very long pale setae interspersed among the much more numerous shorter ones. In *idiophallus*, only setae of an intermediate size are present and these are few and scattered.

Hab. Ecuador (Napo-Pataza).

Holotype, ♂, Rio Huagra yacu, altitude 900 metres, March 31, 1941 (*Macinigre*).

The present fly was taken on the same day and at the same place as a paratype of *Teucholabis* (*Teucholabis*) *luteicolor* Alexander, which, while surprisingly similar in general appearance, has the male hypopygium of entirely different structure.

Neognophomyia cochlearis, sp. n.

General coloration of thorax orange-yellow, patterned with dark brown on pronotum and pleura; knobs of halteres infuscated; femora yellow, the tips very weakly infuscated; wings whitish subhyaline, patterned with brown, including a subbasal cloud before the level of origin of *Rs*; subterminal abdominal segments blackened; male hypopygium with the tergal spines strong and powerful, black, virtually glabrous; inner dististyle unusually large and scoop-shaped, phallosome consisting of a median

depressed plate superimposed by a pair of shorter, narrower blades.

Male.—Length about 6 mm. ; wing 5.5 mm.

Rostrum yellow ; first segment of palpi light yellow, the outer segments more infuscated. Antennæ with scape yellow, pedicel and flagellum brown ; basal flagellar segments oval, the outer ones becoming more elongate, with long, conspicuous verticils. Head light yellow ; anterior vertex relatively narrow.

Pronotum pale yellow, slightly more infuscated on sides. Mesonotum orange-yellow, the scutal lobes weakly darkened ; scutellum slightly infuscated. mediotergite obscure yellow, more infuscated on either side, these areas more or less convergent behind to form a more or less distinct V-shaped marking ; pleurotergite chiefly infuscated. Pleura yellow, the propleura and pteropleurite very weakly darkened, the anepisternum heavily and conspicuously blackened. Halteres with stem yellow, knob infuscated. Legs with the coxæ and trochanters yellow ; femora yellow, the tips very weakly to scarcely darkened ; tibiæ and basitarsi uniformly yellow ; second tarsal segment yellow, its tip and the remainder of the tarsi brownish black. Wings whitish subhyaline, rather heavily and conspicuously patterned with brown, including a moderately wide band at cord and a much broader, more diffuse one nearer the wing base, the outer end of the latter about opposite origin of R_s , behind reaching vein 2nd A but not involving the cell ; seam at cord much more conspicuous over the anterior cord than over $m-cu$, somewhat interrupted at the fork of M ; outer end of cell 1st M_2 narrowly seamed with brown ; veins brownish yellow to yellow, much darker in the patterned areas, especially along the cord. Venation : Sc_1 ending just beyond R_2 ; R_{2+3+4} a little more than one-half R_{3+4} ; vein R_3 oblique, about one-fifth as long as R_4 , the latter ending close to the wing-tip ; R_s relatively long, about one-half longer than vein R_3 ; $m-cu$ just before mid-length of cell 1st M_3 .

Abdominal tergites broadly infuscated on sides, the median region paler ; basal sternites pale, on segments five to seven, inclusive, with both the tergites and sternites more heavily and uniformly infuscated, particularly the tergites ; eighth and ninth segments pale, the style again

more or less darkened. Male hypopygium with the tergal spines long and conspicuous, heavily blackened, on distal half narrowed to acute spinous points; spines glabrous, on distal half more or less twisted, the surface with a ridge or carina that is provided with a very few weak setulæ. Outer dististyle relatively long and slender, its base dilated, at near mid-length more constricted, the elongate outer portion gradually narrowed, bearing five strong setæ, the outermost terminal in position. Inner dististyle unusually large and scoop-shaped, particularly the widely expanded outer lobe, the apex of which is truncated or broadly obtuse, blackened, provided with a few powerful setæ; outer margin of the above with a further fringe of about nine strong black setæ, inner or upper lobe of style low and narrow, its apex blackened, the margin with about five powerful black setæ. Phallosome narrow, consisting of a median depressed plate, its tip obtuse and unmodified, superimposed by two shorter and narrower flattened blades, their tips similarly obtusely rounded.

Hab. Ecuador (Santiago-Zamora).

Holotype, ♂, Zumbi, Rio Zamora, altitude 700 metres, November 2, 1941 (*Laddey*).

The most similar species is *Neognophomyia consociata* Alexander, which has somewhat similar heavily blackened spines. This differs in all details of structure of the hypopygium, including the more strongly setulose and carinate tergal spines and the entirely different dististyles and phallosome.

Neognophomyia scapha, sp. n.

General coloration yellow, the thoracic pleura with a continuous dorsal brown stripe; legs yellow, the tips of the femora, tibiæ and basitarsi weakly darkened; wings pale yellow, with a relatively broad brown seam along cord; abdominal tergites brown, with a conspicuous central yellow stripe; male hypopygium with the phallosome terminating in two blackened reflexed plates, the cephalic ends of which are produced into strong spines.

Male.—Length about 5 mm.; wing 5.2 mm.

Rostrum obscure yellow; palpi light brown. Antennæ with scape and pedicel obscure yellow. flagellum brown;

flagellar segments long-oval to elongate, with conspicuous verticils. Head yellow.

Pronotum yellow, darkened laterally, the pretergites clearer yellow. Mesonotum extensively and chiefly medium brown, the humeral region of præscutum yellowed; no distinct præscutal stripes; scutal lobes a little darker. Pleura yellow, with a conspicuous dorsal brown stripe extending from the cervical region to the pleurotergite and postnotum, the former not more intense in colour, as is common in the genus. Halteres with stem yellow, knob infuscated. Legs with the coxæ and trochanters yellow; remainder of legs yellow, the tips of femora, tibiæ and basitarsi weakly and inconspicuously infuscated; remainder of tarsi dark brown. Wings pale yellow, with a relatively broad brown seam along cord, the outer end of cell 1st M_2 much more narrowly darkened; a vague darkening in proximal portions of cells R and M ; veins pale brown, darker coloured in the clouded portions. Venation: R_2 at near mid-length of petiole of cell R_3 ; $m-cu$ at near mid-length of cell 1st M_2 , the latter narrow.

Abdomen with the central portion of basal and intermediate tergites yellow, the lateral borders broadly dark brown; outer segments more uniformly dark brown; sternites yellow. Male hypopygium having the outer dististyle with its basal portion slightly widened, thence narrowed to the slender tip that terminates in a single elongate seta, with other subapical bristles along the outer margin. Inner dististyle unusually stout, especially at mid-length, at base with a blackened tooth or flange. Phallosome before apex expanded into rounded lobes or shoulders, the actual apex on either side of sædeagus produced into a reflexed flattened plate that terminates in a long powerful spine, the outer margin back from this spine with a few denticles and strong setæ. Tergal spines appearing as strong, nearly straight, blackened blades, their tips acute.

Hab. Ecuador (Napo-Pataza).

Holotype, ♂, Abitagua, altitude 1200 metres, April 4, 1937 (*Macintyre*).

In the structure of the male hypopygium, especially the phallosome, the present fly is entirely different from all others of the now rather numerous species of the genus.

It is somewhat like species such as *Neognophomyia colombicola* Alexander and *N. consociata* Alexander, yet very different.

Erioptera (Erioptera) polytricha, sp. n.

Allied to *multiannulata*; male hypopygium with the outer dististyle slightly widened on more than its basal half, on its lower margin here produced into a flattened lobe that terminates in three or four spinous setæ; apex of style slightly dilated, produced into a single strong spine that is surrounded by a dense brush of setæ.

Male.—Length about 2.8–3 mm.; wing 3.3–3.5 mm.

Female.—Length about 3.5 mm.; wing 3.5 mm.

Rostrum and palpi black. Antennæ black throughout; flagellar segments with very conspicuous verticils in both sexes. Head buffy white.

Pronotum chiefly dark brown, the lateral borders whitened. Mesonotum chiefly dark brown, without distinct pattern. Pleura brown, striped longitudinally with white or greyish white, including a narrow dorsal line from the cervical region to the wing root, and a broader, more ventral stripe from behind the fore coxæ, passing beneath the halteres. Halteres, especially the knobs, pure white. Legs with the coxæ pale brown, the fore pair somewhat darker; trochanters brownish yellow; femora dark brown, ringed with white, the latter less extensive than the former, including three rings, placed respectively at near two-fifths, three-fourths and apex of segment; tibiæ yellowish brown, narrowly whitened at either end, slightly darkened just inside the whitened portions; tarsi pale yellowish brown, the basitarsi darker. Wings with a brownish-yellow tinge, unpatterned; veins and trichia slightly darker yellow. Venation: Cell M_2 open by the atrophy of m ; vein 2nd A relatively long and sinuous.

Abdomen, including hypopygium, brownish black. Male hypopygium with the outer dististyle slightly widened on more than the basal half, on its lower margin here produced into a flattened lobe that terminates in three or four spinous setæ; beyond this point, the style much narrower, at apex again dilated into a head that is produced into a single strong spine and provided with a

dense brush of setæ. Inner dististyle unusually broad and flattened. Gonapophyses with tips obtusely rounded.

Hab. Ecuador (Napo-Pataza).

Holotype, ♂, Abitagua, altitude 1200 metres, April 7, 1937 (*Macintyre*). *Allotopotype*, ♀, April 5, 1937. *Paratopotypes*, 4 ♂ ♀, April 2-11, 1937; November 21, 1937 (*Macintyre*).

Among the regional species, *Erioptera* (*Erioptera*) *polytricha* is most similar to *E. (E.) polydonta* Alexander, of Peru. The two species differ conspicuously in the structure of the male hypopygium. A third described member of the group, *E. (E.) multiannulata* Alexander, of south-eastern Brazil, is still known only from the female sex but will certainly be found to possess strong characters in the hypopygium when the male is available.

Erioptera (*Helobia*) *colombiana microptera*, subsp. n.

Male.—Length about 4.5 mm.; wing 2.8×0.7 mm.

Characters as in typical *colombiana* Alexander, differing especially in the reduced wings of the male and, presumably, also of the still unknown female.

Wings only a little more than one-half the length of body but normally proportioned as to length and breadth; ground-colour yellowish, with the usual spotted and clouded pattern which is only a little less extensive than the pale ground areas; longitudinal veins and tips of veins beyond cloud distinctly clouded. Venation as compared with the typical form showing *Rs* somewhat shorter; supernumerary cross-vein in cell *R*₃ at near two-fifths the length of cell and removed some distance basad from the level of the tip of vein *R*₁₊₂; cell 1st *M*₂ relatively small; vein 2nd *A* at the lowest point of its bend almost reaching the posterior margin. In typical *colombiana*, the ground-colour of the wings is more whitened, with the dark clouds much less extensive in area to the ground. Male hypopygium as compared with the typical form, with the inner dististyle more narrowed but still obtuse at apex. Gonapophyses slightly different, the notch between the outer larger blade and the small, more basal lobe deeper and more conspicuous, the outer blade less produced on its extreme apical portion.

Hab. Ecuador (Chimborazo).

Holotype, ♂, Riobamba, altitude 2700 metres, April 20, 1939 (*Brown*).

Molophilus (Molophilus) brownianus, sp. n.

Belongs to the *plagiatus* group; general coloration dark brown; antennæ (male) relatively elongate, black throughout; halteres blackened; wings with a brownish tinge, the stigmal region faintly darker; male hypopygium with the basal dististyle a moderately long, gently curved rod that terminates in a long straight spine, immediately before apex on lower face with a group of five or six appressed spines.

Male.—Length about 4.3–4.5 mm.; wing 5.2–5.6 mm.; antenna about 2 mm.

Rostrum and palpi black. Antennæ (male) relatively elongate, as shown by the measurements, black throughout; flagellar segments subcylindrical to subfusiform, with abundant outspreading verticils. Head dark brownish grey.

Pronotum dark brown; lateral pretergites obscure yellow. Mesonotum almost uniform dark brown, the præscutal interspaces a little darker than the stripes; scutellum dark. Pleura brownish black, sparsely pruinose. Halteres blackened, knobs elongate. Legs with the coxæ and trochanters obscure brownish yellow; femora yellowish brown; tibiæ brown; tarsi black; fore tibiæ slightly swollen subbasally but not differentiated in colour. Wings with a brownish tinge, the stigmal region faintly darker, ill-delimited; veins pale brown. Venation: Vein R_2 some distance beyond level of $r-m$; petiole of cell M_3 a little longer than the feebly sinuous $m-cu$; vein 2nd A elongate, ending about opposite the cephalic end of $m-cu$.

Abdomen, including hypopygium, black. Male hypopygium with the beak of basistyle relatively slender, acutely pointed at apex. Outer dististyle with the margin of the outer or shorter arm microscopically serrulate. Basal dististyle a moderately long, gently curved, simple rod that terminates in a long straight spine, immediately before apex on the mesal or inner face with a group of five or six appressed spines; remainder of style with scattered setigerous tubercles. Phallosome a depressed glabrous plate, its apex obtuse.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Tungurahua. Minza Chica, altitude 3500 metres, April 7, 1939 (*Brouca*). *Paratopotype*, ♂, April 9, 1939.

I am most pleased to name this species for the collector, Professor F. Martin Brown, whose important paper* on entomological collecting localities in Ecuador is invaluable to workers on this area. The species is closest to *Molophilus* (*Molophilus*) *capricornis* Alexander and *M.* (*M.*) *remiger* Alexander, differing most evidently in the structure of the male hypopygium, especially the basal dististyle.

III.— *On two Diplopods of the Family Vanhoeffeniidae from Indian Caves, with the Description of a new Genus.*
By F. A. TURK, Ph.D., F.R.E.S.

The two Diplopod species described in this paper were sent to me by Brigadier E. A. Glennie, of the Indian Geodetic Survey, and to his kindness I owe the opportunity of examining this interesting material.

The following species of Diplopods have been recorded as being cavernicolous in the Indian area: *Kronopolites unicolor* Attems, *Glyptulus cavernicolus* Silv., *Trachyiulus minus* Silv., *Cambalomorpha* *feæ* Pocock. None of these belongs to the family Vanhoeffeniidae, and, in fact, this family was brought forward as Indian by Carl in 1932. For the most part Indian members of this family occur at altitudes above 1500 metres, and are characteristic forms of the Sholas. Therefore, as so often seems to occur, the present cave-inhabiting species are related to forms more or less confined to higher altitudes. Both forms are nearly related, as are most of the Indian members of this family, to African forms, particularly those occurring most commonly in East Africa. Attems (1936) thinks it is not necessary to postulate an ancient Indo-Madagascan land bridge to explain this distribution, but that these forms once inhabited the present intermediate countries and died out there later, due to consequent climatic changes. This view may one day be substantiated by the finding of other related forms in caves in these inter-

* F. Martin Brown, "A Gazetteer of Entomological Stations in Ecuador," *Ann. Ent. Soc. America*, xxiv. pp. 809-851 (1941).

vening countries, but in the meantime these matters must inevitably be merely ones of opinion. For my part I incline to the view that all these forms evolved from an ancestral stock which originated on this same Indo-Madagascan bridge before the elevation of the Himalayas in mid-Tertiary times.

One interesting point in the anatomy of these two species is the very similar form of the body hairs (figs. 10 and 11). These are bifid at the tip, with one of the branches markedly shorter than the other and tending to come to a point; such hairs occur on all the tergites.

All the material was, unfortunately, in a very poor state of preservation when received by me, and some points in the anatomy await further elucidation when better specimens are available. All the very small Polydesmoidea are notoriously fragile, and this is probably one reason why they are generally neglected by collectors who are not professional myriapodologists.

GLENNIEA, gen. nov.

Allied to *Ootacodesmus* Carl. and *Pseudosphæroparia* Carl.; but besides the definite characters of the male gonopods, the second tergite (*i. e.* metazonite) is narrower than the succeeding ones and projects under the head and the first tergite. The sides of the tergites are only slightly crenulate and the tergites 5, 7, 9, 10, 12, 13, 15 to 18 carry pores. The male appears to have 19 segments with 28 pairs of legs and the female 20 segments with 30 pairs of legs. The third pair of legs of the male are only very slightly thickened. *Gonopods* (figs. 2, 3 4 and 5).—The canal branch of the femur is coiled on the tibia and the tarsus ends in a stiff blade and bears several spine-like hairs as well as an exceptionally broad lamella. Type-species, *Glenniea indica* mihi.

Glenniea indica, sp. n.

About 8.5 mm. long, of an earthy-brown colour. With the characters of the genus and, in addition, the following:—Very little of the head is covered by the first tergite, which bears along its anterior border eight simple, unmodified hairs. The fifth tergite is wider than the immediately preceding ones and has four rows of rather distally thickened hairs, a character which seems to be

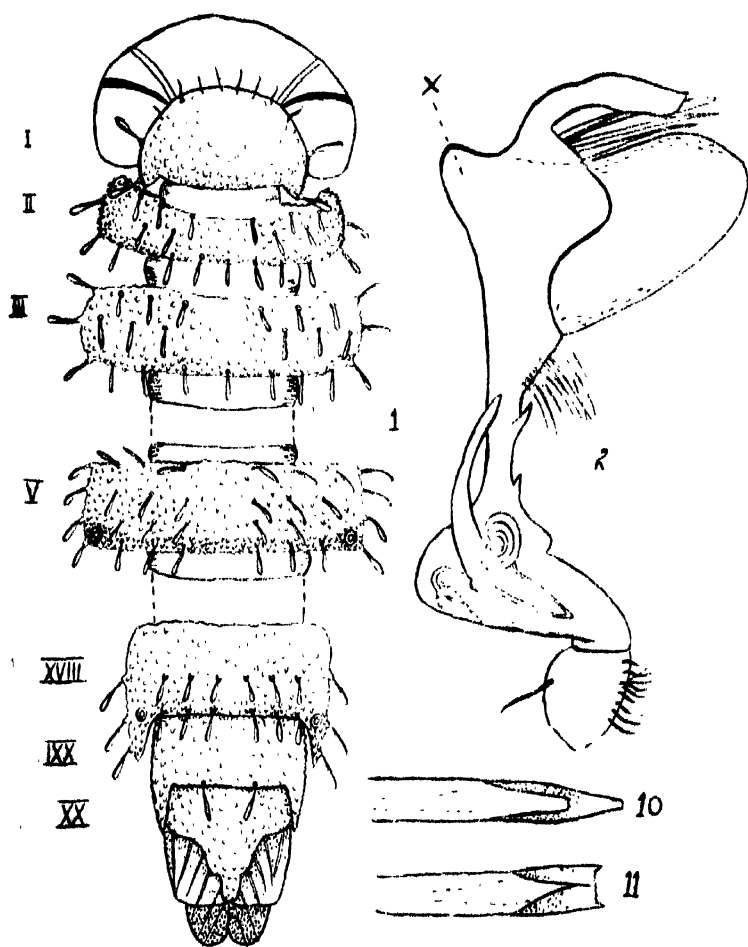
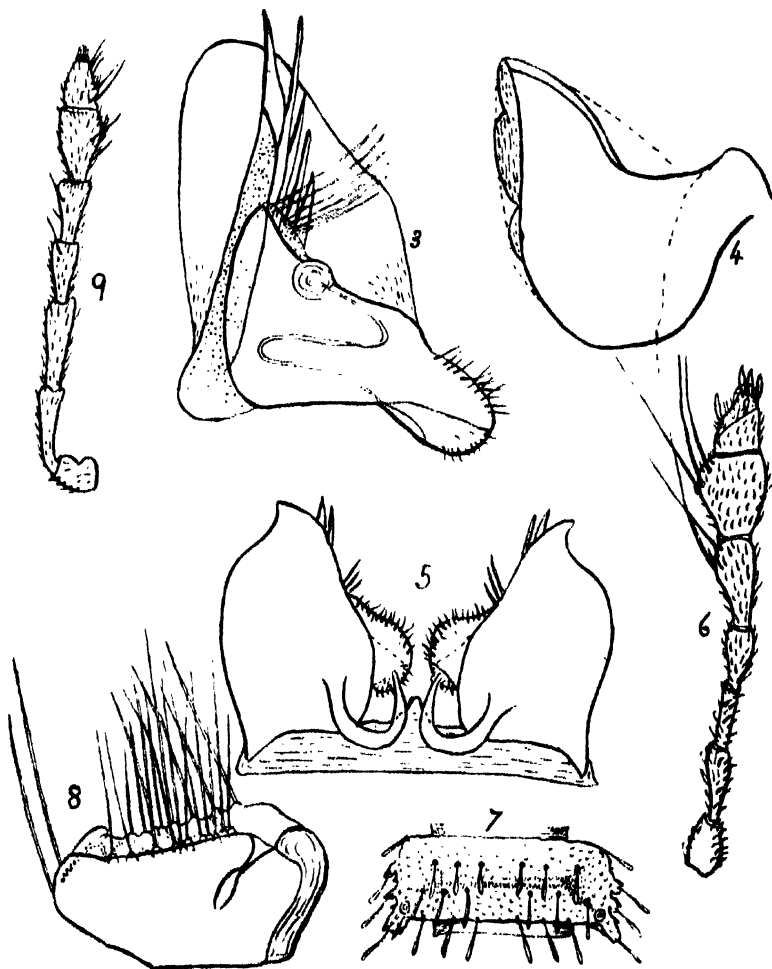


Fig. 1.—*Glenniea indica* : head and tergites.

Fig. 2.— " : gonopods of male extended.

Fig. 10.—*Pseudosphæroporia cavernicola* : hair from one of the tergites.

Fig. 11.—*Glenniea indica* : hair from one of the tergites.



- Fig. 3.—*Glennicea indica*: gonopods of male folded in natural position.
 Fig. 4.— " " "X" of fig. 2 seen in profile.
 Fig. 5.— " " gonopods *in situ* from behind.
 Fig. 6.— " " antenna of male.
 Fig. 7.—*Pseudospharoparia cavernicola*: fifth tergite.
 Fig. 8.— " " vulva of female.
 Fig. 9.— " " antenna.

shared by all the pore-bearing segments as far as the mutilated material available allows of this being made out. The antennæ (fig. 6) have the penultimate segment very much enlarged, and both this and the antepenultimate bear exceptionally long sensory hairs. *Gonopods*.—The tibia bears a long, stout, acute spine and the proximal part of the tarsus, which is very much narrowed, has two very much smaller spines. The tarsus bears a very large lamella, and at the base of this, where it joins the tarsus, is a bluntly produced rounded process. When viewed in profile this is seen to be incurved at the edge, like the finger of a glove (fig. 4), with the lower border very slightly crenulate.

Two males, both damaged, one very damaged female (?) and several damaged immature forms. All the co-types are at present in my collection, and will be transferred later to the British Museum. All from Moila Swallet, Bundelkhand, India.

Pseudosphæroparia cavernicola, sp. n.

This form appears to belong rightly to this genus, although the available material contained no males. Body white, 6.75 mm. long, with 20 segments (female). The tergites are much more deeply indented at the sides (fig. 7) than is the case with other Indian members of this genus. Most of the metazonites bear a slight median ridge and are thickly covered with blunt tubercles. The first tergite only projects a little over the head (a character which, it would seem, sharply demarcates it from the other members of the genus). The antennæ (fig. 9) have the penultimate segment very little developed and bear only a few moderately long sensory hairs. The vulva (fig. 8) has a rather short operculum and a very loosely coiled apodemetic gutter and bears a characteristic arrangement of long sensory hairs.

Two females and several immature specimens from Moila Swallet, Bundelkhand, India. Co-types in my collection and later to be transferred to the British Museum.

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- ATTEMS. 1936. "The Diplopoda of India." Mem. Ind. Mus. xi. p. 133.
 CARL. 1932. "Diplododen aus Sud-Indien und Ceylon.—Teil. 1. Polydesmoides." Rev. Suisse de Zool. t. xxxix. no. 17, p. 411.

IV.—*A Synopsis of the Brazilian Species of Cyllæpus Er. (Coleoptera, Elmidæ).* By H. E. HINTON, Ph.D., Department of Entomology, British Museum (Natural History).

SEVEN species of *Cyllæpus* have been listed from Brazil, viz., *C. gounellei* (Grouv., 1888), *C. brasiliensis* Grouv. (1888), *C. reitteri* Grouv. (1888), *C. sharpi* Grouv. (1888), *C. gigas* Grouv. (1888), *C. confusus* Hint. (1936), and *C. grouvellei* Hint. (1936). The types of all of these were examined by me in 1936 in the Museum of Natural History in Paris. Paratypes of *C. gounellei*, *C. brasiliensis*, *C. sharpi*, and *C. gigas* and a specimen of *C. reitteri* identified by Grouvelle have been available while constructing the key given below. *C. confusus*, of which only the unique type is known, is not available at present and has been omitted from the key. It is not very closely related to any other Brazilian species. *C. grouvellei* Hinton (= *C. granosus* Grouv., 1896) belongs in the genus *Elsianus* Sharp and not in *Cyllæpus* Erichson, as stated by Grouvelle (1896). The trivial epithet *granosus* thus again becomes available for Grouvelle's species, which was sunk as a secondary homonym. The synonymy of this species now stands as follows :—

Elsianus granosus (Grouvelle).

1896. *Cyllæpus granosus* Grouvelle, Not. Leyd. Mus. xviii. p. 44.

1936. *Cyllæpus grouvellei* Hinton, Ent. mon. Mag. lxxii. p. 55.

The bulk of the material which forms the basis of this synopsis was collected in Santa Catharina, Nova Teutonia, by Mr. Plaumann in the years 1934 to 1939. Altogether, it has been necessary to describe nine new species, and the number of these represented by single specimens from southern Brazil is a clear indication that many more species remain to be discovered in that region. A summary of the distribution of the Brazilian species is as follows :—

1. *C. olenus*, sp. n.—F. Guiana, Pará, Amazonas, Matto Grosso.
2. *C. zagreus*, sp. n.—Minas Geraes.
3. *C. gounellei* Grouv.—Minas Geraes.
4. *C. typhon*, sp. n.—Rio de Janeiro (?).
5. *C. reitteri* Grouv.—Rio de Janeiro, Santa Catharina.

6. *C. nelo*, sp. n.—Santa Catharina.
7. *C. brasiliensis* Grouv.—Santa Catharina.
8. *C. sharpi* Grouv.—Santa Catharina.
9. *C. carinulus*, sp. n.—Santa Catharina.
10. *C. nicon*, sp. n.—Santa Catharina.
11. *C. didas*, sp. n.—Santa Catharina.
12. *C. alcine*, sp. n.—Santa Catharina.
13. *C. maro*, sp. n.—Santa Catharina.
14. *C. gigas* Grouv.—Santa Catharina.
15. *C. confusus* Hint.—Santa Catharina.

It is interesting to note that the genus *Cylloepus* is apparently represented at low altitudes in the Amazon basin by a single very widely-distributed species, *C. olenus*, which also occurs in the low-lying coastal areas of French Guiana, although above 1000 metres in the Amazon watershed in Bolivia many species are found (Hinton, 1940). Furthermore, *C. olenus* is very different from any of the other continental American species of the genus so far described. It is not related to any of the southern Brazilian forms, but is obviously related to some of the species of the Greater Antilles, e. g., *C. lahottensis* (Darl.) of Haiti and *C. quadrata* (Darl.) of Cuba. None of the southern Brazilian species is very close to those known from Bolivia, Peru, and Central America, but they are nevertheless much more related to these than to *C. olenus*. Approximately 5400 specimens of Elmidae were collected by me during 1937 in various localities in Matto Grosso, Amazonas, and Pará, and in the coastal part of French Guiana. In all these collections there are only ten specimens of *Cylloepus*—all *C. olenus*, sp. n.

My best thanks are due to M. A. Villiers for the loan of a number of paratypes of Grouvelle's species of *Cylloepus* in the National Museum of Natural History in Paris, and to Dr. B. M. Hobby for the loan of a few specimens of *Cylloepus* in the Oxford University Museum.

A Key to the Brazilian Species of Cylloepus.

1. Elytral epipleura without tomentum except for a very narrow strip near metasternum and abdomen. (Pronotum with sublateral carinae complete; median depression complete, broad on basal two-thirds and narrow on apical third. Elytra with inner carina extending to apical third and third interval strongly

- elevated on basal fifth. Legs with a single apical fringe of long tomentum on each tibia.) French Guiana, Brazil: Porto Velho, Manaus, Belém. *C. olens*, sp. n.
- Elytral epipleura entirely tomentose on basal six-sevenths 2.
2. Middle tibia with a single apical fringe of long, golden tomentum 3.
- Middle tibia with two apical fringes of long, golden tomentum 7.
3. Hypomeron without distinct coarse punctures but with a dense network of microscopic punctures and also with round granules which are very distinct, about as coarse as facets of eyes, and separated by two to five diameters. Pronotum densely granulate on basal third between median impression and sublateral carinae. Elytra with third interval at base only slightly more convex than second and fourth intervals, not cariniform; inner lateral carinae as strongly raised as outer and extending as far caudally. Abdomen without trace of lateral discal carinae on first sternite. Hind trochanter not spinose or noticeably gibbous. Female (and probably also male) with elytral apices very strongly produced and separately pointed, and fifth abdominal sternite nearly vertical. Minas Geraes. [(Grouvelle) (1888). *C. gounellei*
- Hypomeron with distinct coarse and fine punctures but without distinct granules. Pronotum only sparsely and very finely punctate on basal third between median impression and sublateral carinae. Elytra with third interval at base very strongly elevated and cariniform; inner lateral carinae not as prominent nor extending so near to apex as outer carinae. Abdomen with short or long discal carinae on first sternite. Hind trochanter spinose or if not spinose (*C. typhon*, sp. n.) at least with ventral margin strongly gibbous. Female and male with elytral apices broadly, conjointly rounded and fifth abdominal sternite nearly horizontal 4.
4. Pronotum with sides of median longitudinal depression strongly carinate from near base to near apex. Legs with anterior and posterior face of front and anterior face of middle and hind femora without distinct coarse punctures but with flat, highly polished callosities, each of which has a minute seta arising from its distal margin. (Male and female with fifth abdominal sternite horizontal and not channelled and hind trochanter with short spine.) Santa Catharina . . . [(Grouvelle) (1888). *C. brasiliensis*

4. Pronotum with sides of median longitudinal depression broadly convex except sometimes on basal third, where they may be carinate. Legs with anterior and posterior face of front and anterior face of middle and hind femora with large, shallow, oval punctures, each of which has near its proximal margin a flat, setose callosity 5.
5. Pronotum with median longitudinal channel scarcely noticeably impressed on basal third or obsolete. Male with a broad and deep median channel on fifth abdominal sternite; hind trochanter strongly gibbous on middle ventral margin but not spinose. Rio de Janeiro (?). *C. typhum*, sp. n.
- Pronotum with median longitudinal depression deep and distinct on basal third. Male (male of *C. sharpi* is unknown to me) without a distinct channel on fifth abdominal sternite; male and female with a spine on ventral margin of hind trochanter 6.
6. Body moderately pale ferrugineous with head black and femora dark grey. Male and female with a small ventrally directed tooth on middle of anterior margin of prosternum. Female with a deep median longitudinal depression on fifth abdominal sternite. Rio de Janeiro. Santa Catharina [Grouvelle (1888).
C. reitteri
- Body black or brownish black. Female (and probably also male) without a tooth on middle anterior margin of prosternum. Female without a distinct longitudinal depression on fifth abdominal sternite. Santa Catharina [Grouvelle (1888).
C. sharpi
7. Front tibia with a single apical fringe of long tomentum 8.
- Front tibia with two apical fringes of long tomentum 10.
8. Pronotum with sublateral carinae absent on basal two-thirds and distinct only very near anterior margin; median longitudinal impression absent. Elytra with inner lateral carina absent and outer prominent only near apex; third interval only feebly convex, scarcely more convex than second. (Male with inner (posterior) spur of hind tibia strongly curved.) Santa Catharina *C. carinulus*, sp. n.
- Pronotum with sublateral carinae complete from base to apex; median longitudinal impression distinct and moderately deep on middle of disk. Elytra with both inner and outer lateral carinae well developed; third interval strongly raised and cariniform on about basal seventh. 9.

9. Antenna uniformly coloured. Pronotum with coarse punctures on side of median discal impression usually separated by one to two diameters; surface between coarse punctures smooth or with only a few microscopic punctures. Metasternal disk without granules or with only indistinct granules which are finer than facets of eyes. Santa Catharina. *C. nixon*, sp. n.
- , Antenna with two basal segments distinctly paler than apical segments. Pronotum with punctures on side of median discal impression seldom separated by as much as one diameter and often confluent; surface between coarse punctures densely, microscopically punctate. Metasternal disk with numerous distinct granules which are much coarser than facets of eyes. Sao Paulo *C. nelo*, sp. n.
10. Pronotum with sublateral carina only moderately convex and inner edge nowhere sharp; median longitudinal depression very shallow or more or less obsolete. Elytra with inner lateral carinae obsolete near base and only feebly convex apically; third interval moderately convex at base but not carinate 11.
- , Pronotum with sublateral carina very strongly elevated and inner edge sharp; median longitudinal depression deep and complete or nearly so. Elytra with inner carina distinct on basal half; third interval carinate near base 12.
11. Pronotal sublateral carinae without granules but everywhere sparsely and very finely punctate like middle of disk. Santa Catharina *C. didas*, sp. n.
- , Pronotal sublateral carinae on anterior half with low, round granules about as coarse as facets of eyes and usually separated by about two diameters. Santa Catharina. *C. alcine*, sp. n.
12. Pronotum with sides of median longitudinal impression moderately convex, and surface of these sides with only fine punctures. Elytra with third interval carinate on about basal seventh; sutural interval without granules. Scutellum only microscopically and very sparsely punctate; not raised above adjacent part of sutural interval. Abdomen with lateral discal carinae of first sternite indistinct. Santa Catharina *C. maro*, sp. n.
- , Pronotum with sides of median longitudinal impression nearly as strongly elevated as sublateral carinae, and surface of these sides subgranulate. Elytra with third interval carinate on basal half;

- sutural interval granulate near base. Scutellum with numerous granules as coarse as facets of eyes; slightly raised above adjacent part of sutural interval. Abdomen with lateral discal carinae of first sternite strongly elevated, broad, and extending to caudal margin of first segment 13.
13. Surface of elytra on basal half between sutural and third interval and between the latter and inner lateral carina with numerous low, round granules about as coarse as facets of eyes. Male and female without trace of ridges on disk of second abdominal sternite. Santa Catharina [Grouvelle (1888).
C. gigan
- Surface of elytra on basal half between sutural and third interval and between the latter and inner lateral carina without granules. Female (and probably also male, which is unknown) with a very feebly convex longitudinal ridge on each side of disk of second abdominal sternite. Minas Geraes *C. zagreus*, sp. n.

Cyllopus olenus, sp. n.

Male.—Length 3.2–4.2 mm.; breadth 1.4–1.8 mm. Body subparallel and moderately convex. Cuticle feebly shining and pale reddish brown to black with antennae, mouth-parts, and tarsi brownish testaceous. Head with oblong granules about as long as facets of eyes and usually separated by two to four times their lengths; surface between granules very densely and evenly, microscopically punctate. Clypeus with granules finer and less distinct than those of head; surface between with the microscopic punctures less regular, particularly near anterior margin. Labrum with round punctures about one-half to two-thirds as coarse as facets of eyes and separated by one to two diameters; base and extreme apex nearly impunctate; surface between punctures smooth. Pronotum with broadest point, which is at about basal two-fifths, slightly broader than long (1.31 : 1.23 mm.) and base broader than apex (1.23 : 0.85 mm.). Sides broadly and very shallowly sinuate near base. Lateral margins feebly and more or less regularly crenate. Sublateral carinae extending from base to apex, prominent, inner margins sharp, and scarcely noticeably interrupted behind basal two-fifths by oblique depression. Disk with median longitudinal impression complete, broadest (as broad as scutellum) and

deepest on middle of disk, and present as a rather narrow line on apical third; sides of median impression distinctly elevated only on basal fourth; impressions near base on each side of scutellum shallow, oval, and about a fifth as broad as scutellum; oblique basal impression very shallow, scarcely noticeable. Surface of disk with irregular to round very low granules or callosities, which are about as broad as facets of eyes and are usually separated by one to two-and-a-half diameters; from each of these granules arises a recumbent, testaceous seta which is about twice as long as its respective granule; surface between granules densely, microscopically punctate; apical region near anterior margin with granules distinctly finer and sparser; basal fourth or fifth of disk between sublateral carinae more strongly shining and with only a few microscopic punctures; surface of sublateral carinae slightly more coarsely and densely granulate than middle of disk. *Elytra* with broadest point at apical third, where they are slightly but distinctly broader than across humeri. Apices moderately produced and broadly, conjointly rounded. Epipleura without tomentum except for a very narrow fringe adjacent to metasternum and abdomen. Lateral margins more sparsely, finely, and sharply crenate than those of pronotum. Sublateral carinae distinctly carinate, outer extending to about apical fourth and inner to apical third, but more distinct basally. Intervals flat or nearly so, but third strongly carinate on basal fifth; surface of intervals finely, irregularly punctate and feebly rugose and on basal half with few or many low, round granules. Discal striae feebly but distinctly impressed; punctures round (often appearing subquadrate), a third to a half as broad as intervals, and separated longitudinally by one-and-a-half to two diameters. *Scutellum* ovate, as broad as long (0.19 mm.), and very feebly longitudinally impressed; surface strongly shining and with only an occasional microscopic puncture. *Prosternum* with anterior three-fifths (not including process) moderately strongly bent ventrally; process with caudal margin rounded, subangulate; surface coarsely, deeply, irregularly rugose and very densely, evenly, microscopically punctate; near anterior margin, particularly at sides, with round granules

which are slightly finer to as coarse as facets of eyes. Hypomera coarsely, deeply, irregularly rugose. Metasternum with median longitudinal line present on caudal three-fifths, where it is as broad as the base of a tarsal claw; disk nearly flat on caudal three-fourths but on anterior fourth steeply declivous to anterior margin and middle near base feebly depressed; surface with obovate punctures one-half to two-thirds as broad as median longitudinal line, dense and often contiguous, and anterior margin of each with a flat callosity (or granule) which bears a caudally directed, recumbent, testaceous seta; surface between coarse punctures with a dense and even network of microscopic punctures; sides of metasternum with coarse punctures smaller and much sparser. Abdomen with lateral carinæ of first sternite broad, indistinct, and not extending more than half-way to caudal margin opposite hind coxæ. Sternites with coarse punctures finer and sparser than those of metasternum, the coarse punctures becoming progressively finer and sparser towards apex. *Legs* with a single fringe of long golden tomentum near apex of each tibia.

Female.—Externally similar to male.

Type.—A male in the collection of the British Museum (Nat. Hist.). Brazil: Amazonas, Manaus, 11. ix. 1937 (H. E. Hinton).

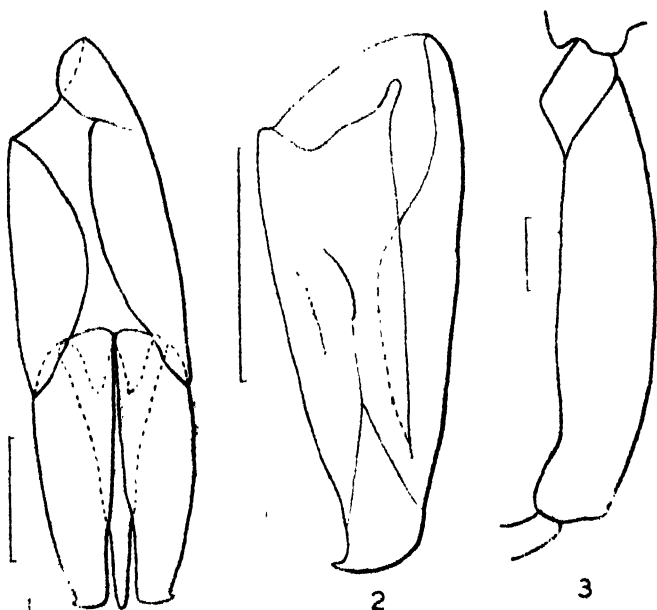
Paratypes.—2, with same data as type; 4, Matto Grosso, Porto Velho, viii.-ix. 1937 (H. E. Hinton); 2, Pará, Belem, ix. 1937 (H. E. Hinton); and 1, French Guiana, St. Laurent du Maroni, x. 1937 (H. E. Hinton).

Comparative Notes.—This is apparently the only continental American species of *Cyllocus* so far described which has the elytral epipleura nearly entirely free of tomentum, and in this respect it resembles *C. lahottensis* (Darl.) of Haiti and *C. quadrata* (Darl.) of Cuba. The side of the prosternum has only a very narrow fringe of obvious tomentum near the noto-sternal suture and the long tomentum on the sides of the metasternum and abdomen is much more restricted than is usual. As regards its structural details, as well as its general appearance, *C. olenus* appears to be more closely related to the two West Indian species mentioned above than to any of its continental congeners.

Cylloepus typhon, sp. n. (Figs. 1-3.)

Male.—Length 3.5 mm.; breadth 1.67 mm. Body subparallel and moderately strongly convex. Cuticle moderately pale rusty brown with head black, femora brownish black, and antennæ, mouth-parts, and tarsi brownish testaceous. Externally similar to *C. reitteri* Grouv. (1888) in colour and structural details, except as

Figs. 1-3.



Cylloepus typhon, sp. n. (1) Dorsal view of male genitalia. (2) Inner lateral view of right paramere of same. (3) Anterior face of hind coxa and femur. Lines next to these and other figures refer to a length of 0.20 mm.

follows:—(1) the median longitudinal channel of the pronotum is broadly obovate and more or less confined to middle two-fifths, being scarcely noticeably impressed on basal third and apical third, whereas in *C. reitteri* this channel extends from base to apex, though it is very narrow and very shallow on apical fourth but on basal

third it is deep and its sides are carinate; (2) the sides of the discal channel have simple coarse punctures, whereas in *C. reitteri* the edges of these punctures are raised so that the surface here is subgranulate; (3) there is no tooth on the middle anterior margin of the prosternum; (4) the metasternum has no gibbositities, whereas in *C. reitteri* there is a very large (larger than hind trochanter) and very prominent gibbosity on each side of the metasternal disk; (5) the fifth abdominal sternite has a median longitudinal depression which is very broad and deep at apex but rapidly becomes shallower and narrower towards base but does not attain the base, whereas in *C. reitteri* there is no distinct longitudinal depression on this sternite; (6) the middle caudal margin of the hind trochanter (fig. 3) is prominently gibbous but not toothed; and (7) the middle and hind tibiae are not so strongly curved near their apices.

Female.—Unknown.

Type.—A male in the collection of the Oxford University Museum. Brazil (*ex. coll. J. W. Miers*). This specimen was probably collected in Rio de Janeiro.

Cyllæpus reitteri Grouvelle.

1888. *Cyllæpus reitteri* Grouvelle, Ann. Soc. ent. Fr. (6) viii. p. 399, pl. 7, fig. 6.

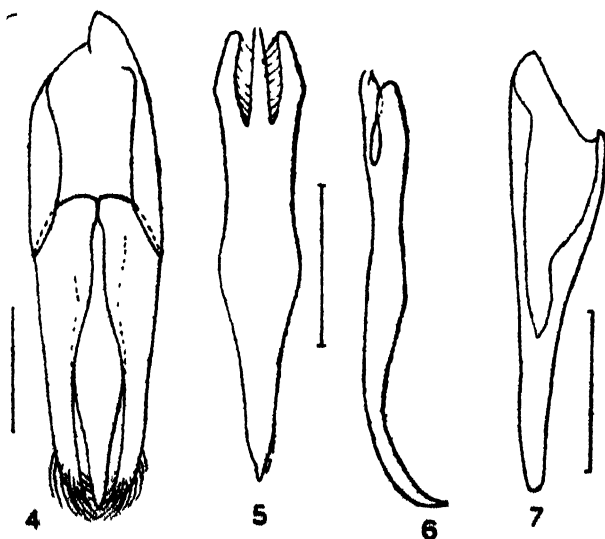
Before me are two specimens, a male from Rio de Janeiro (*J. W. Miers*) and a female from the Miers' collection in the Oxford University Museum. The latter was probably also collected at Rio de Janeiro. The former has been identified by Grouvelle and bears a name-label in his handwriting. This species was described from a series taken at Santa Catharina: Blumenau. In the original description no mention is made of some striking diagnostic features possessed by both sexes, nor are the secondary sexual characters noted. Both sexes have a short, acute, ventrally-directed spine on the middle of the anterior prosternal margin, and both have an acute spine on the distal fourth of the ventral margin of the hind trochanter. The female differs externally from the male as follows:—(1) the prosternal tooth is only about half as long; (2) the side of the metasternal disk is gibbous, but there is here no very prominent and sharply circumscribed gibbosity as in the male; (3) the

disk of the second abdominal sternite is not depressed, whereas in the male the anterior half of the disk has a broad and shallow but distinct median depression; (4) the fifth abdominal sternite is more or less horizontal and has a broad, deep, longitudinal, navicular depression on anterior half, whereas in the male the apex of the fifth sternite is strongly declivous and there is no distinct longitudinal depression; (5) the spine on the ventral margin of the hind trochanter is only half as long; and (6) the tibiae are shorter and the middle tibiae are not distinctly curved near apex.

Cylloepus carinulus, sp. n. (Figs. 4-7.)

Male.—Length 3.8 mm.; breadth 1.5 mm. Body subparallel and moderately convex. Cuticle strongly shining and black, with antennæ, mouth-parts, and tarsi

Figs. 4-7.



Cylloepus carinulus, sp. n. (4) Dorsal view of male genitalia. (5) Dorsal view of median lobe of same. (6) Lateral view of median lobe. (7) Inner view of left paramere.

rufo-piceous. *Head* with dense coarse and fine intermixed punctures. Clypeus sculptured like head but near anterior margin with coarse punctures (two-thirds as

coarse as facets of eyes), sometimes separated by one or two diameters. Labrum with basal third finely alutaceous, apical third nearly smooth, and middle third with punctures slightly finer than anterior ones of clypeus and separated by one to two diameters. *Pronotum* with broadest point, which is at basal two-fifths, slightly broader than long (1.20 : 1.09 mm.) and base broader than apex (1.09 : 0.79 mm.). Sides broadly and scarcely noticeably sinuate before base. Lateral margins feebly roughened, not distinctly crenate. Sublateral carinae present only on apical third and very indistinct except very near anterior margin, where they are feebly carinate and have their inner (mesal) margins sharp. Disk regularly convex, without oblique impressions, and with only an oval and extremely shallow depression on middle. Surface with round, moderately deep punctures which are slightly finer than facets of eyes and are usually separated by two to five diameters; surface between these punctures smooth or nearly so; surface near lateral margin on anterior three-fifths with punctures denser and often much coarser. *Elytra* with broadest point at about apical two-fifths, where it is scarcely broader than across humeri. Apices broadly, moderately strongly produced and broadly, conjointly rounded. Epipleura clothed with dense tomentum except at extreme apex. Intervals with third scarcely noticeably more convex than second; sixth (inner sublateral carina) scarcely convex; eighth (outer carina) moderately convex and extending to apical fourth, on apical half to apical fourth carinate with mesal margin sharp; other intervals flat or nearly so; surface of intervals with sparse punctures distinctly finer than those of pronotal disk. Discal striae scarcely impressed; discal striae punctures deep, round, nearly as broad as intervals, and separated longitudinally by usually slightly more than their diameters. *Scutellum* flat, not raised above adjacent parts of sutural interval, broadly oval, longer than broad (0.19 : 0.14 mm.), and finely and very sparsely punctate. *Prosternum* with anterior two-thirds (not including process) feebly and gradually bent ventrally; process with caudal margin broadly rounded; anterior margin broadly, shallowly, and arcuately emarginate at middle; surface of anterior half with numerous round

granules finer than facets of eyes and posteriorly and on process punctate, somewhat like anterior sides of pronotum; sides entirely clothed with dense tomentum. Hypomera coarsely, rugosely punctate and with an even, dense network of microscopic punctures. Metasternum with median longitudinal line very deep and broader than base of a tarsal claw on caudal two-thirds, and thence narrower and shallower and nearly attaining anterior margin; disk moderately depressed, particularly on middle near base; surface of basal half with dense punctures as coarse as those of prosternum; anterior half of disk much more finely and sparsely punctate. *Abdomen* with disk of first sternite moderately strongly declivous from caudal fourth to anterior margin; lateral discal carinae broad, very short, and indistinct. Disk of sternites two to four more densely and slightly more coarsely punctate than disk of first sternite. Fifth sternite with basal three-fifths punctate and caudal two-fifths granulate like anterior middle region of prosternum. *Legs* with a single apical fringe of long, golden tomentum on front and hind tibiae; middle tibiae with two parallel apical fringes of long golden tomentum. Hind tibia with inner spur long, strongly curved, and sharply pointed.

Female.—Unknown.

Type.—A male in the collection of the British Museum (Nat. Hist.). Brazil: Santa Catharina, Nova Teutonia, iii. 1936 (F. Plaumann).

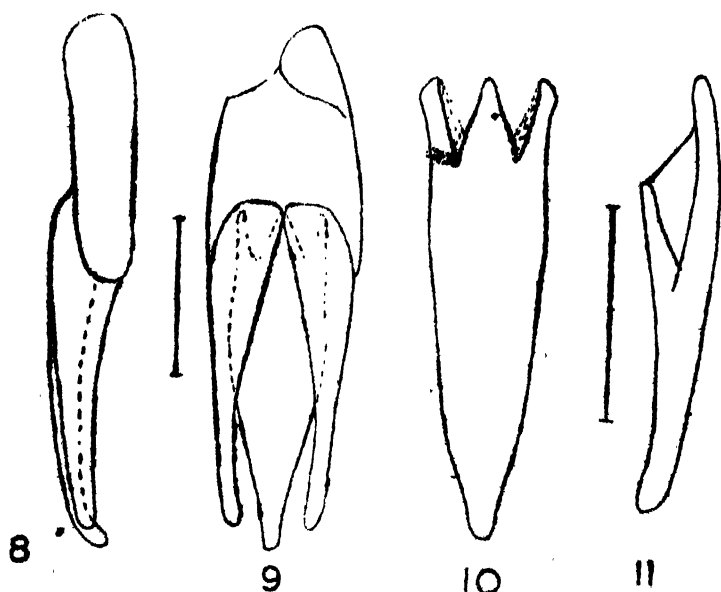
Comparative Notes.—From all other known species of *Cylloepus*, this may be distinguished by having the sub-lateral pronotal carinae confined to the anterior third of the pronotum.

Cylloepus nicon, sp. n. (Figs. 8–11.)

Male.—Length 3.6–4.0 mm.; breadth 1.3–1.6 mm. Body subparallel and only moderately convex. Cuticle strongly shining and black with antennae, mouth-parts, and tarsi rufo-piceous; tibiae darker rufo-piceous. *Head* rugose with dense coarse and fine intermixed punctures and with an occasional fine, indistinct granule at sides. Clypeus sculptured like front of head but near anterior margin with coarse punctures more widely separated and

surface between them much smoother. Labrum with basal third finely alutaceous, apical third nearly smooth, and middle third with punctures about two-thirds as coarse as facets of eyes and separated, by one to two diameters, the surface between these punctures being nearly smooth. *Pronotum* with broadest point, which is at about basal two-fifths, very slightly broader than long (1.12 : 1.09 mm.) and base broader than apex (1.01 : 0.76 mm.). Sides not sinuate or scarcely noticeably sinuate before base. Lateral margins feebly and

Figs. 8-11.



Cyllopus nixon, sp. n. (8) Right lateral view of male genitalia. (9) Dorsal view of same. (10) Dorsal view of median lobe. (11) Inner view of right paramere.

more or less regularly crenate. Sublateral carinae extending from a point extremely near base to apex, broad, moderately prominent, inner (mesal) margins sharp, and sinuate and scarcely noticeably depressed where crossed by oblique basal depressions. Median longitudinal depres-

sion deep, broadly oval, and confined to middle third of pronotum, the sides of this depression not being distinctly elevated. Oblique basal depressions broad and shallow but distinct. Base in front of scutellum with a low, broad (as broad as scutellum), flat-topped ridge. Impression near base on each side of scutellum broad, deep, and nearly round. Surface of disk with round to irregularly-shaped shallow punctures which are slightly but distinctly coarser than facets of eyes and are usually separated by one to two diameters; surface between these punctures nearly smooth; basal third with punctures much finer and very much more widely separated; middle apical region with punctures only slightly coarser than those of basal third; surface of sublateral carinae and of anterior half between sublateral carinae and lateral margins subrugose but with no distinct granules. *Elytra* with broadest point, which is at about apical two-fifths, scarcely broader than across humeri. Apices broadly, moderately strongly produced and broadly conjointly rounded. Epipleura densely tomentose except very near apex. Intervals with third subcarinate on basal seventh; sixth (inner carina) prominent and subcarinate to apical third; eighth (outer carina) prominently carinate to apical fourth; other intervals flat or very feebly convex; surface of intervals with sparse and fine punctures, but at extreme base with punctures slightly coarser, much denser, and the surface between them subrugose. Discal striae hardly or not at all impressed; discal striae punctures deep, round to subquadrate, about as broad as intervals, and separated longitudinally by about one to one-and-a-half diameters. *Scutellum* scarcely noticeably convex, not distinctly raised above adjacent parts of sutural interval, obovate, and distinctly longer than broad (0.16:0.12 mm.); surface sparsely, microscopically punctate. *Prosternum* with anterior four-fifths (not including process) moderately strongly deflexed ventrally; prosternal carinae short but prominent; process with caudal margin strongly rounded; anterior margin nearly truncate; surface coarsely, rugosely punctate as well as microscopically punctate, and sides of process very finely, longitudinally strigose; anterior sides with a few granules

which are slightly finer than facets of eyes; all of sides densely tomentose. Hypomera coarsely, rugosely punctate and also with a very dense and even network of microscopic punctures. Metasternum with median longitudinal line nearly complete to anterior margin and on most of disk deep and slightly broader than base of a tarsal claw; disk more or less flat, tomentose, and occasionally with fine, sparse, indistinct granules; base on each side with a broad, transverse depression. *Abdomen* with disk of first sternite very deeply and broadly depressed and carina on each side very prominent and extending two-thirds of distance to hind margin opposite hind coxa. Disk of first sternite densely, microscopically punctate caudally, sparsely microscopically punctate anteriorly, and with at least caudal half entirely tomentose; disk of sternites two to four densely, microscopically punctate, and also with fine, low, sparse granules; disk of fifth only feebly inclined and near apical margin with granules coarser and much denser. *Legs* with a single apical fringe of long golden tomentum on front and hind tibiae; middle tibiae with two parallel apical fringes of long golden tomentum.

Female.—Externally similar to male.

Type.—A male in the collection of the British Museum (Nat. Hist.). Brazil: Santa Catharina, Nova Teutonia, 1934 (*F. Plaumann*).

Paratypes.—5, with same data as type, and 16, with same data but collected in March, 1936.

Comparative Notes.—This species is most closely related to *C. nelo*, sp. n., and the differences between the two are given under the heading of the latter species.

Cyllæpus nelo, sp. n.

Female.—Length 3.8 mm.; breadth 1.5 mm. Externally very similar to *C. nicon*, sp. n., from which it may be distinguished as follows:—(1) the antenna is pitchy black with the two basal segments dark brownish testaceous, whereas in *C. nicon* it is uniformly brownish piceous or rufo-piceous; (2) the punctures of the middle pronotal disk are usually nearly twice as large as the facets of the eyes, they are seldom separated by more than half of

one diameter, and the surface between them is densely, microscopically punctate instead of nearly smooth; (3) the prosternal carinae are indistinct instead of prominent; (4) the disk of the metasternum is very distinctly granulate, the granules being slightly but distinctly coarser than facets of eyes, more or less flat-topped, and separated by one-and-a-half to three diameters, whereas in *C. nicon* the disk has only indistinct granules which are distinctly finer than facets of eyes; and (5) the disk of the first abdominal sternite is only moderately instead of very deeply depressed.

Male.—Unknown.

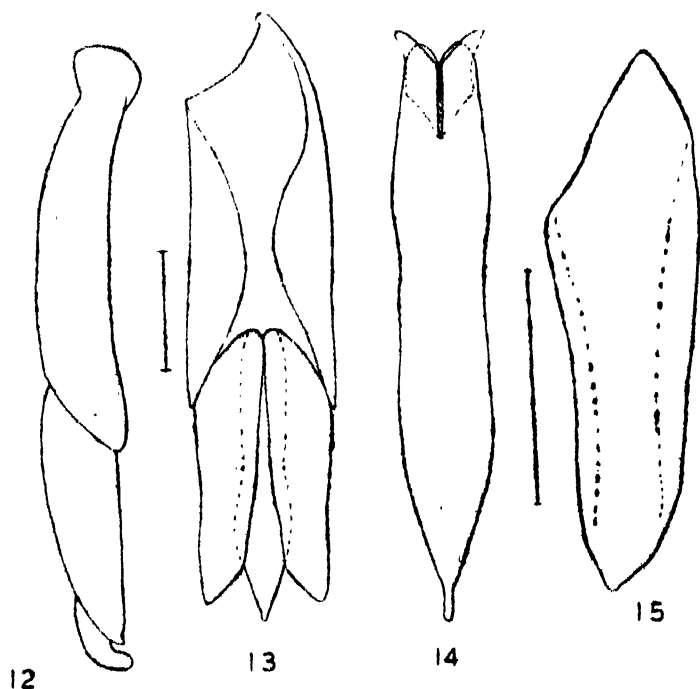
Type.—A female in the collection of the British Museum (Nat. Hist.). Brazil: Sao Paulo, iv. 1924.

Cylloepus didas, sp. n. (Figs. 12–15.)

Male.—Length 4.3–4.5 mm.; breadth 1.7–1.9 mm. Body subparallel and moderately convex. Cuticle strongly shining and black with antennae and mouth-parts reddish brown, tarsi rufo-piceous, and tibiae darker rufo-piceous than tarsi; elytra and ventral parts of body sometimes dark rufo-piceous. *Head* with a dense network of microscopic punctures and also with much coarser (about half as large as facets of eyes) punctures which are separated by about three to six diameters; each of these coarse punctures has its edge slightly raised so that the surface appears to be subgranulate in some lights. Clypeus with punctures slightly coarser than coarse ones of head and usually separated by two to four diameters; surface between punctures usually smooth. Labrum nearly smooth on basal and apical thirds and more densely and slightly more coarsely punctate on middle third. *Pronotum* with broadest point, which is near middle, broader than long (1.53 : 1.42 mm.) and base broader than apex (1.34 : 1.07 mm.). Sides not sinuate or only scarcely noticeably and broadly sinuate before base. Sublateral carinae extending from near base to apex, moderately depressed where crossed at about basal third by oblique impressions, and broad and only feebly raised except very near apex, where they are narrow, carinate, and have their inner (mesal) margins

sharp. Median longitudinal depression only represented by a narrow, extremely shallow line extending from basal third to apical fourth. Oblique impressions only distinct near and on sublateral carinae. Impression near base on each side of scutellum punctiform and about as broad as an eye-facet. Surface with punctures about half as

Figs. 12-15.



Oylaeopus didas, sp. n. (12) Right lateral view of male genitalia. (13) Dorsal view of same. (14) Dorsal view of median lobe. The basal wing-like cuticle is thin, and its broken part is represented by an interrupted line. (15) Inner view of right paramere.

coarse as facets of eyes, usually separated by four or five diameters, and surface between them smooth; surface of sublateral carinae similarly punctate; basal third with punctures finer and much sparser, being usually separated by ten or more diameters. Disk in front of scutellum

more or less evenly convex, without the usual distinct ridge or channel with raised sides. *Elytra* with humeri only slightly narrower than broadest point at about apical two-fifths. Apices moderately strongly, broadly produced and broadly, conjointly rounded. *Epipleura* entirely clothed with dense tomentum except very near apex. Intervals with third moderately strongly convex but not carinate on basal seventh; sixth and eighth (inner and outer carinae) feebly convex basally but moderately strongly convex apically, the inner "carina" extending to about apical fourth and the outer slightly beyond; other intervals flat or scarcely noticeably convex; surface of intervals punctate like pronotal disk but occasionally also slightly rugulose. Discal striae not impressed; discal stria punctures very deep, round to subquadrate, as broad as intervals, and separated longitudinally by one or slightly more than one diameter. *Scutellum* broadly oval, slightly longer than broad (0.24 : 0.22 mm.), nearly flat, not raised above adjacent parts of sutural interval, and surface with only an occasional microscopic puncture. *Prosternum* with anterior four-fifths (not including process) gradually and moderately bent ventrally; prosternal carinae short and distinct, particularly when viewed laterally; process with caudal margin broadly rounded and only very feebly angulate; surface finely, sparsely punctate and subrugose, but densely punctate like clypeus on anterior half and with a few granules on anterior sides. *Hypomera* feebly, sparsely rugose, with a few coarse but very shallow punctures, and on caudal fourth with many microscopic punctures. *Metasternum* with median longitudinal line extending from base nearly to anterior margin and very narrow except from near base to anterior fourth, where it is moderately deep and about as broad as base of a tarsal claw; disk broadly and shallowly depressed, entirely tomentose, and subgranulate. *Abdomen* with disk of first sternite strongly depressed, non-tomentose on anterior half and middle of caudal half where it is sparsely and finely punctate, and lateral carinae indistinct but complete to caudal margin. Second sternite with a small, median, non-tomentose patch on anterior fourth; third to fifth sternites entirely tomentose except for

extreme apex of fifth, which has some round granules. *Legs* with two parallel apical fringes of long, golden tomentum on front and middle tibiae; hind tibiae with only a single apical fringe of long golden tomentum.

Female.—Externally similar to male.

Type.—A male in the collection of the British Museum (Nat. Hist.). Brazil: Santa Catharina, Nova Teutonia, iii. 1936 (*F. Plaumann*).

Paratypes.—4, with same data as type.

Comparative Notes.—This and the two following new species belong in a distinctive species-group. The members of the *didas* species-group have the sides of the prosternum, the whole of the metasternum—including the disk—and all the abdominal sternites except the disk of the first, a small discal area of the second, and extreme apex of the fifth entirely clothed with dense tomentum. The tibiae of all legs are proportionally thicker than those of any other Brazilian species. There are two parallel apical fringes of long golden tomentum on the tibiae of both the front and middle legs. The sublateral carinae of the pronotum and elytra are only feebly to moderately convex, and there are no granules on the middle of the pronotal disk.

Cyllopus alcine, sp. n.

Female.—Length 5.0 mm.; breadth 2.0 mm. Externally identical to *C. didas* except as follows:—(1) the body is slightly larger (length 4.3–4.5 : 5.0 mm.); (2) the median longitudinal depression of the pronotum is slightly deeper, more distinct, and extends to basal fourth; and (3) the sublateral pronotal carinae are slightly more prominent and on anterior three-fifths have low but distinct granules which are as coarse to slightly coarser than facets of eyes and are separated by one to three diameters, the surface between these granules being sometimes densely, microscopically punctate, whereas in *C. didas* the anterior three-fifths of the sublateral pronotal carinae is as finely and sparsely punctate as middle of disk.

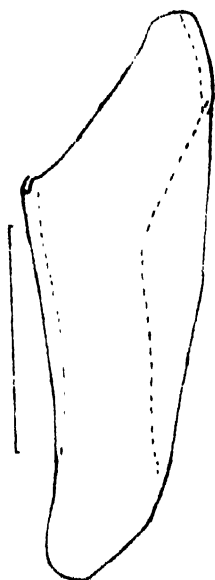
Male.—Unknown.

Type.—A female in the collection of the British Museum (Nat. Hist.). Brazil: Santa Catharina, Nova Teutonia, ii. 1936 (F. Plaumann).

Cyllæpus maro, sp. n. (Fig. 16.)

Male.—Length 5.0 mm.; breadth 2.0 mm. Externally very similar to both *C. didas*, sp. n., and *C. alcine*, sp. n. It agrees with the description given for *C. didas* except

Fig. 16.



16

Cyllæpus maro, sp. n. Inner view of right paramere.

in the following particulars:—(1) the median longitudinal impression of the pronotum is about as broad as the scutellum, one-third as deep as broad, and extends from basal fifth, where it is much shallower, to apical fourth; (2) the disk in front of the scutellum has a feebly-raised,

flat-topped ridge which is as broad as scutellum, whereas in both *C. didas* and *C. alcine* the middle base of the pronotum is more or less evenly convex; (3) the pronotal sublateral carinæ are moderately strongly elevated instead of only feebly convex, and the inner (dorso-mesal) margins are everywhere more or less sharp, whereas in *C. didas* the inner margins of the sublateral carinæ are evenly rounded and in *C. alcine* well-marked only on anterior fourth; (4) the surface of the sublateral carinæ on outer four-fifths is subgranulate and much more coarsely and densely punctate than the middle of the disk; (5) the sides of the pronotum are slightly more distinctly sinuate before the base than in *C. alcine*; (6) the elytra have the inner carinæ moderately convex and the outer strongly raised; (7) the third interval is strongly raised and carinate on basal seventh instead of only moderately convex as in *C. didas* and *C. alcine*; (8) there are a few low granules on the middle of the hypomera and the surface is everywhere reticulately alutaceous or with a dense network of microscopic punctures, whereas in both *C. didas* and *C. alcine* there are no granules on the hypomera and the surface between the coarse, shallow punctures is often smooth; and (9) the male genitalia differ from those of *C. didas* (cf. figs. 15 and 16) in the shape of the parameres, and *C. maro* has the base of the median lobe produced into three long and well-separated struts.

Female.—Unknown.

Type.—A male in the collection of the British Museum (Nat. Hist.). Brazil: Santa Catharina, Nova Teutonia, i. 1939 (*F. Plaumann*).

Cylloepus zagreus, sp. n.

Female.—Length 4.5 mm.; breadth, 1.8 mm. Body subparallel and moderately strongly convex. Cuticle feebly shining and black with antennæ and mouth-parts dark brownish testaceous; tarsi rufo-piceous and remainder of legs darker rufo-piceous. *Head* with round to slightly oblong granules as coarse as to a third coarser than facets of eyes, and usually separated by less than one to one-and-a-half diameters; surface between granules with a dense network of microscopic punctures. Clypeus

without granules but with coarse (about half as broad as facets of eyes) and microscopic punctures densely intermixed; near anterior margin with both sizes of punctures much sparser. *Pronotum* with broadest point, which is at about basal two-fifths broader than long (1.50 : 1.40 mm.), and base broader than apex (1.36 : 1.37 mm.). Sides nowhere distinctly sinuate. Sublateral carinae extending from base to apex, very strongly elevated, inner (dorso-mesal) margin sharp, and moderately deeply and broadly channelled at basal two-fifths where they are crossed by the oblique basal impressions. Median longitudinal depression complete and subparallel; shallow near base and very near apex but deep elsewhere; sides of median depression nearly as broadly and strongly elevated as sublateral carinae. Oblique impressions broad and shallow basally but narrower, deeper, and more distinct where they bisect sublateral carinae. Oval depression near base on each side of scutellum punctiform, shallow, and about a fifth as broad as scutellum. Surface of median and sublateral carinae densely and subgranulately punctate; granules low, oval, as coarse as those of head, each with a relatively coarse puncture, and usually separated by half of one to one diameter; surface between median and between median and sublateral carinae with an occasional low granule, with coarse, shallow, indistinct punctures, and with surface between granules and coarse punctures sometimes smooth and sometimes microscopically punctate. *Elytra* with humeri only slightly narrower than broadest point, which is at apical third. Apices broadly, moderately strongly produced and broadly, conjointly rounded. Epipleura densely tomentose except at extreme apex. Sublateral carinae strongly carinate and both extending to about apical fifth, the inner extending very slightly nearer apex than the outer. Third interval on basal half more broadly and nearly as strongly carinate as sublateral carinae; other intervals flat or nearly so; surface of sublateral carinae, third interval on basal half, and sutural interval on basal fifth granulate and punctate like pronotal carinae; surface of other discal intervals only sparsely and microscopically punctate. *Scutellum*

nearly round with base truncate, very slightly longer than broad (0.25 : 0.24 mm.), top flat, and slightly but distinctly raised above adjacent parts of sutural interval; surface slightly more sparsely granulate than sutural interval. *Prosternum* with anterior six-sevenths (not including process) gradually and moderately feebly bent ventrally; lateral carinae low and indistinct; process with caudal margin rounded but distinctly angulate; surface granulate like pronotal carinae and also rugose. *Hypomera* with an occasional granule, particularly near dorsal margin, and with coarse, shallow, indistinct punctures, the surface between the latter occasionally smooth but more often with numerous microscopic punctures. *Metasternum* with median longitudinal line fine and nearly complete; caudal three-fifths of disk very broadly and moderately deeply depressed so that it is on nearly the same level as the disk of the first abdominal sternite; surface entirely tomentose and with granules usually separated by once to twice their diameters. *Abdomen* with disk of first sternite very deeply depressed and lateral discal ridge on each side, complete to caudal margin of segment, very strongly carinate and moderately narrow; most of middle of depressed area non-tomentose. Second sternite with a very feebly-raised, short, longitudinal line on each side of disk and with median line of disk non-tomentose; sternites two to five entirely tomentose except for extreme apical region of fifth. *Legs* with two parallel apical fringes of long golden tomentum on front and middle tibiae; hind tibiae with only a single fringe of long tomentum.

Male.—Unknown.

Type.—A female in the collection of the British Museum (Nat. Hist.). Brazil: Minas Geraes, Ouro Fino, Boa Ventura.

Comparative Notes.—This species can only be compared with *C. gigas* Grouv. In addition to the differences between the two mentioned in the key, it should be noted that the disk of both the metasternum and first abdominal sternite is more strongly depressed than in the female of *C. gigas*. The fifth sternite of *C. gigas* has a narrow, complete, median longitudinal non-tomentose

line, whereas all but the extreme apex of *C. zagreus* is clothed with fine tomentum.

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OBITUARY.

SIR ARTHUR SMITH WOODWARD, F.R.S.

Sir Arthur Smith Woodward, the eminent vertebrate palæontologist, who was born at Macclesfield on May 23, 1864, died at Haywards Heath on September 2, 1944. While still at Macclesfield Grammar School he obtained a special prize for geology, and after studying for two years at Owens College, Manchester, he was appointed at the age of eighteen to an Assistantship in the Geological Department of the British Museum (Natural History). He followed Dr. Henry Woodward (who was no relation) as Keeper of Geology in 1901, and occupied the post with great distinction until his retirement in 1924. The building up of the national collection of fossils, begun by König in the early years of the nineteenth century and ably continued by G. R. Waterhouse and Henry Woodward, was one of Smith Woodward's most notable achievements, particularly, of course, in the field of vertebrate faunas, and in pursuit of material he travelled extensively in Europe and America.

His writings covered the whole field of vertebrate palæontology, from amphibians to man, with the main emphasis on fossil fish. His 'Catalogue of Fossil Fishes in the British Museum' in four volumes (1889-1901) set a high standard of accuracy and comprehensiveness, and will long remain an essential work of reference, while his 'Outlines of Vertebrate Palæontology' (1898) has stimulated many students. Although he did not issue any further editions of the 'Outlines' to

incorporate later advances in knowledge, its place is, to some extent, taken by his translation (in part) and revisions (1902, 1925, 1932) of the vertebrate sections of Zittel's 'Textbook of Palaeontology.' For the Palaeontographical Society (of which he was secretary for many years) he produced memoirs on the 'Fossil Fishes of the English Chalk' (1902-12) and of the 'English Wealden and Purbeck Formations' (1916-19), and elsewhere he described collections of fossil fishes from almost every quarter of the globe. He contributed scores of papers to the 'Annals and Magazine of Natural History,' the first appearing in 1887 and the latest in 1942, while from 1923 onwards he was one of its Conductors. It is interesting to record that in his early days he was well acquainted with Edward Charlesworth, who conducted the new series of the Magazine of Natural History as long ago as 1837.

He took his full share in the work of numerous scientific societies, and had served as president of the Linnean and Geological Societies and the Geologists' Association. Among his many honours were the Lyell and Wollaston medals of the Geological Society, the Linnean medal, a Royal medal from the Royal Society, the Prix Cuvier of the French Academy, the Hayden medal of the Philadelphia Academy of Science and the Mary Clarke Thompson medal of the United States National Academy of Sciences. He was elected to the Royal Society in 1901 and knighted in 1924.

To many outside the specialised field of ichthyology, Smith Woodward's name will be mainly associated with Piltdown man, discovered by Charles Dawson in 1911. Their joint paper appeared in the 'Quarterly Journal of the Geological Society' in 1913, and from that time Woodward's interests were largely centred on fossil man. On his retirement in 1924 he settled at Haywards Heath, conveniently near those Piltdown gravels which he and Dawson between them sifted almost grain by grain. His last piece of work, when cut off by blindness from many of his activities and contacts, was the writing of a popular book (yet to be published) summing up his final views on the problem of man's early ancestors.

W. N. E.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 86. FEBRUARY 1945.

V.—Notes on Polyzoa (Bryozoa).—II. *Membranipora crassimarginata* auctl., with Remarks on some Genera.
By ANNA B. HASTINGS, M.A., Ph.D., British Museum (Natural History).

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4. *Crassimarginatella exilimargo* Canu and Bassler.
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Aconthodesia perfragilis (MacGillivray).

Summary.

References.

Acknowledgments.

I am grateful to Professor R. S. Bassler, the 'Discovery' Committee, the John Murray Expedition, and the Cambridge and Manchester Museums, for specimens discussed in this paper.

Crassimarginatella Canu.

Crassimarginatella Canu, 1900, pp. 353, 369; Harmer, 1926, p. 222 (synonymy).

? *Valdemunitella* Canu, 1900, pp. 353, 369.

? *Pyrulella* Harmer; 1926, p. 225.

Genotype.—*Membranipora crassimarginata* Hincks 1880 a.

Pyrulella.—Harmer introduced the genus *Pyrulella* for three species, namely, the genotype, *Membranipora pyrula*

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Hincks (1881 *b*, p. 3), *M. corbula* Hincks (1880 *b*, p. 378), and *M. maderensis* Waters (1898, p. 677).

It is noticeable that these species are closely matched by species of *Crassimarginatella* and *Valdemunitella*, which differ from them chiefly in the more or less complete absence of spines.

Thus *Valdemunitella valdemunita* only differs from *Pyrulella pyrula* in the almost complete absence of spines (there may be a very small one on each side near the distal end), in the presence of an umbo on the proximal gymnocyst and in its slightly wider cryptocyst. The ovicells and avicularia are closely similar. A Tertiary fossil from Napier, New Zealand, is of interest in this connection. It was referred by Waters (1887, p. 45) to *Membranipora monostachys* Busk, but was evidently quite distinct from that species*. It had ovicells like those of *Valdemunitella valdemunita* and *Pyrulella pyrula*. The figure might well represent *V. valdemunita*, with which it agrees in the proximal umbo, and the single spine on each side near the distal end; but according to the description there were numerous spines round the opesia. Avicularia were not found.

The relationship of *Crassimarginatella papulifera* (MacGillivray, 1882, p. 116) and *Pyrulella corbula* appears to be similar to that of *Valdemunitella valdemunita* and *Pyrulella pyrula*, as *C. papulifera* differs from *P. corbula* in having an umbo, no spines, and a slightly wider cryptocyst. The avicularia are very similar. Ovicells resembling those of *P. corbula* were described in Tertiary material of *C. papulifera* by Waters (1887, p. 46, as *M. solidula*, see Waters, 1898, p. 686)†, and are present in two recent specimens from New Zealand in the British Museum (52.3.13.1 and 34.4.14.1) which I believe to belong to *C. papulifera*. These specimens appear to be old. They are rather massively calcified with many regenerated zoecia. The avicularia, which are only to be seen in one of the two specimens, are like those of

* *Membranipora monostachys* Busk (1854, p. 61) is a synonym of *Membranipora crustulenta* (Pallas), see Borg (1931, p. 12).

† Waters (1924, p. 605) again united the British *Membranipora (Alderina) solidula* and the Australasian *Membranipora (Crassimarginatella) papulifera*, but they are clearly distinct. In particular *A. solidula* has pore-chambers (see Norman, 1903, p. 596, pl. xiii, fig. 8, and his specimen 19.6.25.54).

C. papulifera. Spines are almost completely absent, but traces of a few very small ones can be detected.

The specimens described as *Pyrulella corbula* by Harmer (1926, p. 226) and the very similar *Pyrulella maderensis* appear to be to some extent intermediate between *P. corbula* and *C. papulifera* in that the cryptocyst is a little wider than it is in typical *P. corbula*, and the spines are more delicate and the marginal ones less definitely arched over the aperture.

According to Harmer's definitions (1926, pp. 222, 225) *Crassimarginatella* only differs from *Pyrulella* in the absent or vestigial spines, and in the gymnocyst, which is described as "slight or vestigial" in the one genus, "distinct or reduced" in the other.

We have seen that neither of these features is constant, and thus, according to the definitions, there is no reason for keeping the genera apart. The close similarity between species attributed to the two genera shows that this agreement is not merely a matter of definition. Thus, *Pyrulella* cannot be maintained as a distinct genus. *Pyrulella pyrula* goes into *Valdemunitella*, making *Pyrulella* a synonym of *Valdemunitella*; but the other species of *Pyrulella* mentioned above must go into *Crassimarginatella*. It seems likely, however, that *Valdemunitella* is itself a synonym of *Crassimarginatella* (see below).

Some of the species subsequently referred to *Pyrulella* by various authors do not seem to be very closely related to those just discussed. *Membranipora corniculifera* Hincks (1882, p. 468), transferred to the genus by Canu & Bassler (1929, p. 100), is certainly excluded by its adventitious avicularia.

Since the foregoing passages were written Silén (1942, p. 23) has shown further reasons for modifying the definition of *Crassimarginatella* to admit species with well-developed spines. He, nevertheless, still maintains *Pyrulella* as a distinct genus.

Valdemunitella.—Canu introduced *Valdemunitella*, genotype *Membranipora valdemunita* Hincks (1885, p. 248), as an "artificial" subgenus of *Membranipora*, distinguished by the shape of its avicularia from the "artificial" subgenus *Crassimarginatella* introduced at the same time.

The character of the ovicell is mentioned in the definition of *Crassimarginatella*, but not in that of *Valdemunitella*.

Canu & Bassler (1920, p. 131) considered that "the form of the large interzoecial avicularia, the absence of the pivot ["solid pivot," i. e. bar], and the peculiar form of the mandibles are important arguments for . . . the creation of a separate genus," but left the decision "for the future." Later (1933, p. 28) they recognized that the avicularia do not satisfactorily differentiate these subgenera (or genera) and tried to distinguish them by the closure of the ovicells, stating that the operculum closes the ovicell in *Valdemunitella* and does not do so in *Crassimarginatella*, although they have on several occasions (Canu, 1917, p. 131; Canu & Bassler, 1920, p. 130; 1929, p. 101) stated correctly that the operculum closes the ovicell in *Crassimarginatella* (*Grammella*) *.

Waters (1924, p. 605) considered that the lateral depressions (fenestræ) of the ovicell distinguished *Valdemunitella*. It appears to me, too, that if the two genera are to be distinguished the shape and structure of the ovicell are the most important features. It seems likely, however, that *Crassimarginatella* and *Valdemunitella* are synonymous, a conclusion hinted at by Harmer (1926, p. 223). Norman (1903, p. 595) included *Membranipora valdemunita* in *Oochilina* (= *Crassimarginatella*) *.

The gymnocyst, mentioned by Harmer as being more developed in *Valdemunitella*, is quite extensive in some species of *Crassimarginatella*, e. g., *C. japonica* (Ortmann) and *C. marginalis* (Kirkpatrick), and is so variable in extent in different zoecia of the same colony in *Valdemunitella exilimargo* Canu & Bassler, that I doubt whether it has even specific significance.

Key to the Species of Crassimarginatella and Valdemunitella discussed here.

- | | |
|--|--------------------------------|
| 1. Avicularian mandible hinged to complete bar | 1. <i>C. crassimarginata</i> . |
| Avicularian mandible hinged to pivots | 2. |
| 2. Ovicell vestigial | 5. <i>C. spatulifera</i> . |
| Ovicell not vestigial | 3. |

* As noted by Waters (1924, p. 605), *Crassimarginatella*, *Grammella*, and *Oochilina* all have the same genotype. See also Harmer (1926, p. 222).

3. Ovicell broad and very shallow with a small tubercle on each side 6. *C. tuberosa*.
Ovicell not unusually shallow, and without tubercles 4.
4. Ovicell punctate 3. *C. japonica*.
Ovicell not punctate 5.
5. Ovicell longer than broad, with two fenestrae and a median suture (*Valdemunitella*) 6.
Ovicell not longer than broad, fenestra, if present, not constant in form or position 8.
6. Mandible relatively long and narrow 7.
Mandible broad 4. *C. exilimargo*.
7. Gymnocyath not umbonate, spines well developed *C. pyrula*, see p. 70.
Gymnocyath umbonate, spines very rare.. *C. valdemunita*; see p. 70.
8. Mandible broad with sides not markedly incurved 9.
Mandible relatively narrow with markedly incurved sides *Crassimarginatella* sp.
(*M. crassimarginata* Kirkpatrick), see p. 75.
9. Spines well developed *C. corbula* and *C. madeirensis*, see pp. 70, 71.
Spines absent 10.
10. Gymnocyath umbonate *C. papulifera*, see p. 70.
Gymnocyath not umbonate 11.
11. Avicularian opesia relatively long, mandible nearly straight-sided *Crassimarginatella* sp.
(*M. crassimarginata*, Thornely MS), see p. 77.
Avicularian opesia relatively short, mandible with incurved sides 2. *C. marginalis*.

1. *Crassimarginatella crassimarginata* (Hincks).
(Fig. 1 A.)

Membranipora crassimarginata Hincks, 1890 a, p. 71, pl. ix. figs. 1, 1 a; 1891, p. 86; Waters, 1898, p. 685, pl. xlvii. fig. 4; 1924, p. 605.

Crassimarginatella crassimarginata Canu, 1900, pp. 353, 369, text-fig. 11 [after Hincks]; Norman, 1909, p. 287 (synonymy); Osburn, 1940, p. 363.

? *Crassimarginatella crassimarginata* Calvet, 1931, p. 59.

Oochilina crassimarginata Norman, 1903, p. 595.

Grammella crassimarginata Canu, 1917, p. 131, pl. ii. fig. 2; Canu & Bassler, 1920, p. 131, text-fig. 32 A, B [after Hincks and Waters], pl. xxiv. figs. 13-15.

Not *Membranipora crassimarginata* Kirkpatrick, 1890 b, p. 16.

Distribution.—Recent: Madeira (Hincks; Waters; Norman); Porto Rico (Osburn); Bermuda (Osburn); ? Cape Verde Islands (Calvet); Mediterranean (Waters). Fossil: Eocene (Jacksonian), U.S.A. (Canu & Bassler); Miocene (Burdigalian), France (Canu).

Holotype.—The Madeiran Polyzoa described by Hincks (1890 a, pp. 69-80) were sent to him by Mr. J. Y. Johnson. They are not represented in the Hincks Collection in the

British Museum, and presumably remained in Johnson's collection. Norman (1909, pp. 275, 276) mentions that Johnson submitted specimens to Hincks and others for identification, and that his collection is in Madeira. Thus, the type-specimen of *Crassimarginatella crassimarginata* is presumably in Madeira, and is at present inaccessible to me.

I have based my comparisons on Madeiran material in the Norman Collection (11.10.1.616) which agrees very closely with Hincks's description.

Description.—*Crassimarginatella crassimarginata* is particularly characterized by its θ -shaped avicularium (fig. 1 A), which is more or less oval and of about the same size as the autozoecia, and has the mandible hinged to a complete bar which divides the avicularium almost in half*.

The characters of the avicularium were clearly shown in Hincks's figures and were appreciated by Canu & Bassler, Norman and Osburn. but the view expressed by Waters (1924) that the species is "largely based on thick walls" seems to have been prevalent, and may account for some of the misidentifications.

Although usually spineless, as described by Hincks, *C. crassimarginata* does occasionally have a few spines. For example, Norman's Madeiran specimens have a pair of small spines placed close together at the distal end of a few of the zoecia.

There is a good deal of variation in the shape of the avicularia examined by me. Some are quite long and narrow (cf. Hincks, fig. 1 a), some have a nearly semi-circular mandible, and others are even broader in proportion to their width.

Examination of Records.—The species has usually been supposed to have an almost world-wide range—see, for example, Calvet's statement of its distribution. It appears, however, that, apart from the fossils, true *C. crassimarginata* has only been found in the warmer parts of the North Atlantic and, probably, in the Mediterranean.

The existence of this species as far back as the Eocene is rather surprising, but the figures given by

* The incomplete bar of one of the avicularia figured by Hincks was probably broken. The bar is constantly complete in the material examined by me. Hincks mentions the bar in his description.

Canu & Bassler fully support their view that there is no reason for treating the American fossil specimens as a distinct species.

The avicularia of Canu's fossils from the Miocene of France have the complete transverse bar. Canu considered that these specimens possessed a second type of avicularium with pivots, and the figured avicularium of this kind certainly looks somewhat different in shape from those with a complete bar. On the other hand, it is to be expected that the bar would sometimes be broken in fossilized specimens, and the avicularia with a complete bar are very variable in shape. Canu defined *Grammella*, genotype *Membranipora crassimarginata*, as having the ovicell closed by the zoecial operculum, but stated that the ovicell of his fossils was not closed in this way and appeared to open by a special orifice. There is nothing in his figure to support this suggestion. On the whole I am inclined to accept the identity of these fossils with *Crassimarginatella crassimarginata*.

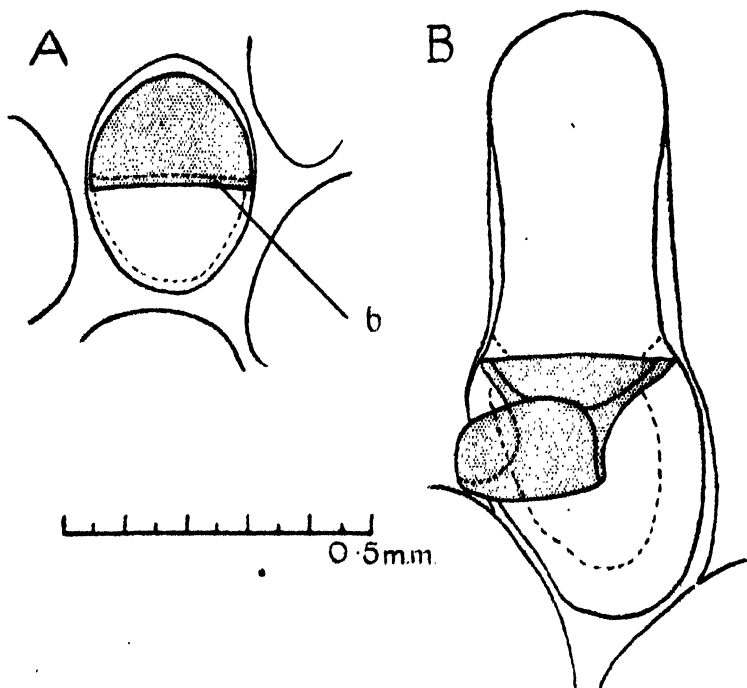
The Mediterranean record rests on Waters's authority. His figure of a specimen from Naples may represent true *C. crassimarginata* but is inconclusive, and the specimens are not at present accessible. The difference in the ovicells noticed by Waters is probably only an age difference. In Norman's material of *C. crassimarginata* from Madeira the successive phases in the calcification of the ovicell can be seen in a single colony. The ectoœcium has at first a large part of its frontal surface uncalcified. As calcification proceeds this membranous area comes to be longer in the transverse axis, and to have a median constriction. This may lead to the state with two uncalcified areas, or subsequent calcification may obliterate this entirely, so that the ovicell appears uniformly calcareous, with or without a transverse ridge.

Calvet's specimen from the Cape Verde Islands might be expected to belong to the Madeiran species, but he says that, except that it was encrusting, it agreed very closely with Busk's variety *erecta*. As that variety has proved to be based on a specimen of *Acanthodesia perfragilis* (MacG.), see p. 98, it is difficult to know what species Calvet had.

The original material of *Membranipora crassimarginata* Kirkpatrick from the Tizard Bank, China Sea, consists

of two slides, which prove to represent different species. One (89.8.21.39) is a species of *Crassimarginatella* differing from *C. crassimarginata* in its avicularia (fig. 1 B). which have a longer, narrower, spatulate mandible, with

Fig. 1.



- A, *Crassimarginatella crassimarginata* (Hincks), Madeira, 11.10.1.616.
 B, *Crassimarginatella* sp. (*Membranipora crassimarginata* Kirkpatrick not Hincks), Tizard Bank, 89.8.21.39.

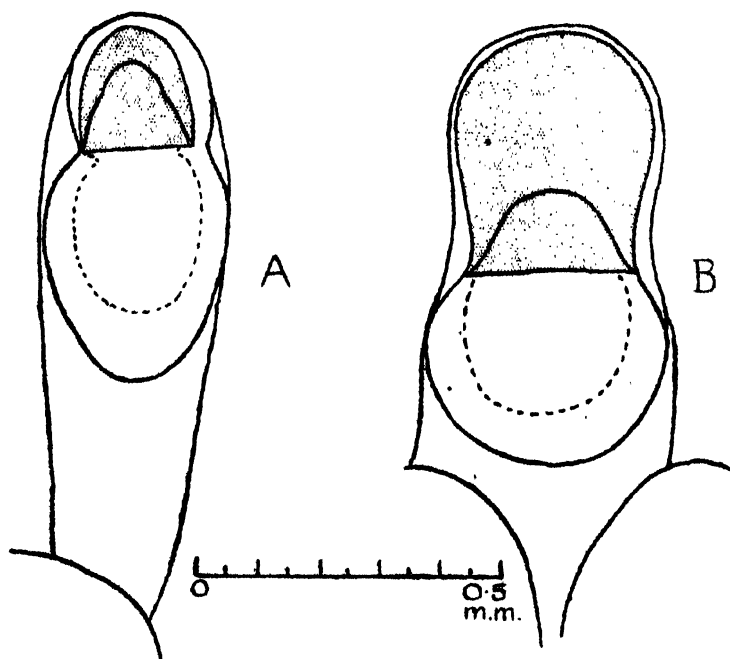
Outlines of avicularia of dry specimens seen by reflected light. Positions of apertures of some adjoining zoecia indicated. Mandible stippled. Edge of cryptocyst represented by broken line. Mandible of B, open and curled in drying. Dotted line shows portion of edge that is seen through curled part of mandible.

b., complete avicularian bar.

incurved sides, which is hinged to small pivots. The other species (89.8.21.18) has pore-chambers, which exclude it from *Crassimarginatella*, and there are spines all round the opesia. The avicularia are vicarious, but have mandibles with a triangular base and a narrow

rhachis, which expands again distally, and is truncated, so that the outline of the two ends is closely similar. Kirkpatrick's *Crassimarginatella* resembles *C. intermedia* Canu & Bassler (1933, p. 27) in its avicularia, but the ovicell has a transverse ridge and is not carinated.

Fig. 2.



- A, *Crassimarginatella* sp. (*M. crassimarginata* Thornely MS. not Hincks), Saya de Malha, 1936.12.30.168, slightly oblique view.
 B, *Crassimarginatella marginalis* (Kirkpatrick). Type-specimen, Mauritius, 88.1.25.8.

Outlines of avicularia of dry specimens seen by reflected light. Position of the apertures of some adjoining zoecia indicated. Mandible stippled. Edge of cryptocyst represented by broken line.

A specimen from the Saya de Malha, Indian Ocean (Thornely Collection, 1936.12.30.168), labelled as *Membranipora crassimarginata* by Thornely, but not included in the paper (1912) in which she described material from that locality, differs from typical *Crassimarginatella crassimarginata* in its avicularia (fig. 2 A). They have a

long opesia, a slightly raised beak, and a narrower mandible hinged to pivots.

I have also examined the specimens "like *Membranipora crassimarginata* Hincks," from British Columbia, mentioned by Waters (1924, p. 605), kindly lent to me by the Manchester Museum. They prove to be specimens of *Callopora brevispina* and *C. triangulata* O'Donoghue (1926, p. 81). They were sent to Mr. Waters, unnamed, by Professor O'Donoghue.

I have not seen the original material of *Membranipora quadricornuta* Waters (1918, p. 9), described as resembling *Membranipora crassimarginata* except for the possession of cervicorn spines. The British Museum possesses material from Porto Grande, St. Vincent, Cape Verde, which is virtually the type-locality (Vallentin Coll. 35.3.6.370, 371, 372). It appears to be rightly referred to Waters's species. Although resembling *Crassimarginatella crassimarginata* in a general way, there are differences in the detail of the zoëcia and the avicularia (ovicells are absent) which make the agreement less close than is suggested by Waters's remark. The Vallentin specimens clearly belong to the form described by Marcus (1938, p. 30) as *Membraniporella aragoi*, but I doubt whether it is the species recognized as Savigny's by Harmer (1926, p. 473). If Harmer's form has pore-chambers, as he suggested, the two are certainly distinct.

Ortmann described Japanese specimens as *Membranipora crassimarginata* var. *japonica*. This variety is given specific rank (p. 79) as *Crassimarginatella japonica* (Ortmann).

Busk described two varieties of *Membranipora crassimarginata* from the 'Challenger' collection, namely, var. *erecta* and var. *incrustans*, but Hincks (1891, p. 86) pointed out that they showed important differences from typical *M. crassimarginata*. They are discussed under *Crassimarginatella exilimargo* (p. 79), *Ellisina incrustans* (p. 91), and *Acanthodesia perfragilis* (p. 98).

2. *Crassimarginatella marginalis* (Kirkpatrick). (Fig. 2 B.)

Membranipora marginalis Kirkpatrick, 1888, p. 74, pl. vii, fig. 2.

Distribution.—Mauritius (Kirkpatrick).

Holotype.—Mauritius, 88.1.25.8.

Remarks.—Kirkpatrick gave an accurate account of the autozoecia of this species but overlooked the few avicularia that are present in the type-material. These avicularia (fig. 2 B) are of about the same size as the autozoecia. They have broad mandibles with the sides slightly incurved near the proximal end. The mandible is hinged to pivots, and the beak is slightly raised.

The avicularium of the species from the Saya de Malha (fig. 2 A) differs from that of *C. marginalis* in its longer opesia, and in its smaller, nearly straight-sided mandible.

3. *Crassimarginatella japonica* (Ortmann).

Membranipora crassimarginata var. *japonica* Ortmann, 1889, p. 28, pl. ii. fig. 3.

Crassimarginatella crassimarginata var. *japonica* Silén, 1942, p. 23, text-figs. 17-18 (references).

Distribution.—Japan (Ortmann ; Silén).

Remarks.—I have not seen a specimen of this form, but it is clear from Silén's description that it shows no specially close resemblance to *C. crassimarginata* sens. str. The avicularia differ in the shape of the mandible and the corresponding shape of the beak, which is raised and toothed ; in the articulation of the mandible, which is hinged to pivots, not to a complete bar ; and in the punctate ovicell, which is quite unlike that of *C. crassimarginata*. I therefore propose that Ortmann's variety should be given specific rank.

Silén suggested that Marcus's specimens (1921, p. 97) may not have belonged to Ortmann's variety, but to *C. kumatze* (Okada). I have therefore omitted Juan Fernandez from my statement of the distribution of *C. japonica*.

4. *Crassimarginatella exilimargo* Canu & Bassler.

(Fig. 3.)

Crassimarginatella exilimargo Canu & Bassler, 1928 b, p. 61, pl. i. fig. 5.

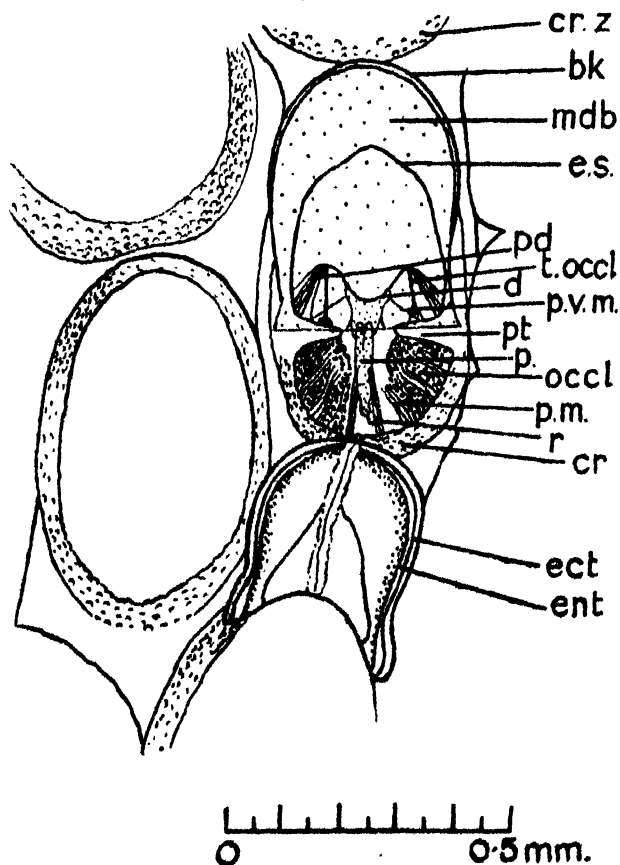
Membranipora crassimarginata var. *incrustans* Busk, 1884, p. 63, pl. xv. figs. 5, 5 a*.

Not *Membranipora incrustans* Waters, see *Ellisia incrustans*.

Distribution.—Brazil, 21° 48' S., 40° 3' W., 128 m. (Canu & Bassler) ; Nightingale Island, Tristan da Cunha,

* The five zoecia, or parts of zoecia, on the right-hand side of fig. 5 a appear to have been added by the engraver. They are not present in Busk's drawing, or in the figured specimen (87.12.9.312).

Fig. 3.



Crassimarginatella exilimargo Canu & Bassler. 'Discovery' St. 399.
Non-fertile zoöcium, vicarious avicularium, ovicell and parts of adjoining zoöcia.

bk., beak; *cr.*, cryptocyst of avicularium; *cr. z.*, cryptocyst of distal zoöcium; *d.*, diaphragm; *ect.*, thick wall of ectoöcium; *ent.*, entoöcium; *e. s.*, edge of shelf; *mdb.*, mandible (light stipple); *occl.*, occlusor muscle (heavy stipple) underlying the parietal muscles; *p.*, polypide (medium stipple); *pd.*, parieto-diaphragmatic muscle; *p. m.*, parietal muscle; *pt.*, pivot; *p. v. m.*, parieto-vaginal muscle; *r.*, retractor muscle of polypide; *t. occl.*, tendon of occlusor muscle.

'Challenger' St. 135 c, 201-274 m. (Busk); off Gough Island, 141-102 m. ('Discovery' Investigations, St. 399 *).

Description.—In the 'Discovery' specimens of this species the zoecia have an oval aperture with a narrow, tuberculate cryptocyst. The gymnocyst is smooth and very variable in extent. There are no pore-chambers. The ovicells are hyperstomial, prominent, and at least as long as wide (fig. 3). They have a median, longitudinal, rib-like suture, and on each side of it a more or less triangular uncalcified patch in the ectozoecium.

The avicularia (fig. 3) are about the same size as neighbouring zoecia. They have a narrow, granular cryptocyst, an incomplete bar, a wide oral shelf, and a slightly raised beak. The mandible occupies more than two-thirds of the length and is broad, with the sides slightly incurved near the proximal end. Each avicularium has a miniature polypide which, from the completeness of its gut, tentacle-sheath, and diaphragm, and the full development of its musculature must be assumed to be functional. This assumption is supported by the presence of brown granules, resembling food particles, in the lumen of the caecum of most of these polypides. The avicularian polypides have a few (? 2-4) thick, short tentacles. The strong occlusor muscles of the mandible lie on each side of the polypide, occupying all the basal part of the avicularian chamber. A series of parietal muscles, the retractor muscles of the polypide, two pairs of parieto-vaginal muscles, and a pair of muscles originating near the point of insertion of the occlusor muscles can also be seen. On the analogy of the zoecium figured by Harmer (1902, pl. xv. fig. 4), in which all the structures noticed in this avicularium appear to be recognizable, the pair of muscles by the occlusors is parieto-diaphragmatic. Silén (1938, p. 289) put the avicularia of this type into his fifth category of vicarious avicularia, and apparently had some doubt as to whether they were true avicularia. Marcus (1939, pp. 185-189, English summary, p. 273) also discusses their nature.

Many of the zoecia of the 'Discovery' material, including some with ovicells, contain large quantities of sperm.

* See footnote, p. 91.

Synonymy.—Professor Bassler has kindly compared part of the 'Discovery' material with the type-specimen of *Crassimarginatella exilimargo* and confirms my identification.

The specimens of *C. crassimarginata* var. *incrustans* (Busk) from 'Challenger' St. 135 c, Nightingale Island, Tristan da Cunha (87.12.9.312 and 99.7.1.1003) agree with the 'Discovery' material in all characters of the zoeecia and avicularia that can be determined from dry specimens. Unfortunately they are without ovicells (unless a broken structure distal to one of the zoeecia is, as it appears to be, the remains of a hyperstomial ovicell), but the proximity of Gough Island to Tristan da Cunha makes it very probable that the 'Discovery' species is that figured by Busk.

Busk gave *Biflustra lacroixii* Smitt (1873, p. 18). not Audouin, as a doubtful synonym of *Membranipora crassimarginata* var. *incrustans*. It is generally agreed that Smitt had more than one species. As noted by Osburn (1940, p. 351), Smitt's fig. 87 may well have been the species commonly known as *Membranipora lacroixii* (= *Conopeum reticulum* (Linn.), see Harmer, 1926, pp. 210, 211)*. Smitt's figs. 85 and 86 appear to represent a single species, distinguished from *C. reticulum* by the presence of ovicells, and resembling *Crassimarginatella tuberosa* (Canu & Bassler), see p. 85. The ovicells are broad and very shallow, and quite unlike those of *C. exilimargo*. Smitt's last figure (fig. 88) shows some resemblance to *C. exilimargo*. As, however, avicularia and ovicells are not shown by Smitt, and *C. exilimargo* is not known from Florida, there is no positive evidence for relating them.

* Calvet (1931, p. 48) recorded two distinct species as *Conopeum lacroixii* (Busk, not Audouin) and *C. reticulum* (Linn.) respectively. There is no evidence as to the species for which he used these names, but it is clear from his references to the works of Harmer (1926) and Canu & Bassler (1920) that he had misunderstood the synonymies given by them.

He was probably partly misled by Harmer's footnote (1926, p. 211). According to the notes on the original drawing, Busk's pl. civ. fig. 1 was drawn from a specimen of *Flustra distans* Hassall from Dublin Bay, "sent by Hassall to W. Thompson", not from the specimen from the Cape Verde Islands examined by Harmer. The latter specimen (54.11.15.219) belongs to *Membranipora tenuirostris* Hincks (1880, p. 70).

Harmer noticed the close agreement in zoecial and avicularian characters between *C. crassimarginata* var. *incrustans* (Busk) and *C. spatulifera* Harmer (see p. 84), but, in the absence of ovicells in Busk's type, was uncertain whether they were identical. Harmer's species is clearly distinguished from that of the 'Discovery' by its vestigial ovicells, and I think the latter has a better claim to be Busk's form.

Marcus (1921, p. 97) was of opinion that Busk's figures and description referred to *Membranipora* (*Ellisina*) *incrustans* Waters, the small avicularia having been overlooked by Busk. Large avicularia, such as are mentioned by Busk and shown in his figure, are not, however, found in *Ellisina incrustans*, which is redescribed below.

Comparison of C. exilimargo and C. crassimarginata.—Busk (1884, p. 63) and Hincks (1891, p. 86) both described *C. crassimarginata* as being more robust than var. *incrustans* (= *C. exilimargo*). They apparently referred to the width and coarseness of the cryptocyst, not to the size of the zoecia, which are larger in *C. exilimargo*. Actually the thickness of the cryptocyst is variable in both species, but there appears to be a fairly constant difference in the character of its granulation, which in *C. crassimarginata* tends to give it a striated appearance and a crenulated edge, neither of which are seen in *C. exilimargo*.

The two species are most readily distinguished by their ovicells and avicularia. In *C. crassimarginata* the ovicells are wider than long and the uncalcified part of the ectozoecium changes its form as the ovicell develops (see p. 75 above), but is essentially irregular and transverse. The avicularian mandible is more or less semicircular (with convex sides), and is hinged to a complete bar. In *C. exilimargo* the ovicells are longer than wide with a median longitudinal suture and a pair of roughly triangular uncalcified areas in the ectozoecium; and the avicularian mandible is longer in proportion to its width, with slightly incurved sides, and is hinged to a pair of pivots (cf. figs. 1 A and 3). The ovicell of *C. crassimarginata* may pass through a phase with two uncalcified areas, but they are less definite than those of *C. exilimargo*, and differ in shape, and there is no median suture. In the

ovicell of *C. exilimargo* no marked changes with age have been noticed, and the median suture is a distinct feature.

Generic Position.—*Crassimarginatella exilimargo* appears to be closely related to *Membranipora valdemunita* Hincks (1885, p. 248) from New Zealand. The ovicells of *C. exilimargo* are very similar to those of *M. valdemunita*, but there is no umbo on the gymnocyst, and the avicularia are shorter and broader. If the genus *Valdemunitella* were to be maintained (see p. 72) *Crassimarginatella exilimargo* would have to be placed in it.

Regeneration.—In a specimen of *C. exilimargo* from 'Discovery' St. 399 a zoecium bearing an ovicell has been regenerated as an avicularium and the same has been seen in *C. crassimarginata* (Norman Coll. 11.10.1.616 from Madeira). In the latter specimen one of the avicularia is directed towards the proximal end of the zoecium in which it lies. In *C. exilimargo* a case of regeneration of an avicularium as a zoecium was also observed. The calcareous parts of the avicularium (beak, oral shelf, pivots) are all complete. Inside it is a zoecium with a separate cryptocyst, filling the space limited by the edges of the shelf and cryptocyst of the avicularium. As in the other zoecia, the operculum has a simple chitinous rim. The parietal muscles can be seen and the zoecium contains a brown-body.

5. *Crassimarginatella spatulifera* Harmer.

Crassimarginatella spatulifera Harmer, 1926, p. 223, pl. xiv, figs. 2, 3.

Distribution.—Malay Archipelago (Harmer); Zanzibar Region (John Murray Exp. St. 111, 1942.5.14.4, 5).

Remarks.—Harmer tentatively included *Membranipora crassimarginata* var. *incrustans* (pars) Busk in the synonymy of this species, but Busk's variety has proved to belong to *Crassimarginatella exilimargo* Canu & Bassler (see p. 82), which is chiefly distinguished from *C. spatulifera* by its well-developed hyperstomial ovicells.

Specimens collected in the Zanzibar region by the John Murray Expedition to the Indian Ocean appear to belong to *C. spatulifera*. They have avicularia of similar shape, and much reduced ovicells which do not accommodate the embryo.

6. *Crassimarginatella tuberosa* (Canu & Bassler).

Aplousina tuberosa Canu & Bassler, 1928 a, p. 21, pl. ii. figs. 4, 5 ; Osburn, 1940, p. 357.

? *Bifurcata lacroixii* Smitt (part), 1873, p. 18, pl. iv. figs. 85, 86.

? *Membranipora filum* Jullien, 1903, p. 41, pl. v. fig. 4 (with footnote by Calvet).

? *Callopora filum* Calvet, 1931, p. 57.

Distribution.—Gulf of Mexico (Canu & Bassler) ; Florida (Canu & Bassler ; ? Smitt) ; Porto Rico (Osburn) ; ? Azores (Jullien, Calvet).

? *Type-material*.—Professor Bassler has kindly supplied me with further particulars of the two specimens selected by him as cotypes :—

No. 7453, " Albatross," St. D. 2405, figured specimen.

No. 7454, " Albatross," St. D. 2387, described specimen.

A specimen from St. D. 2387 was sent to the British Museum by Professor Bassler (32.3.7.95).

Station D. 2387 is not included in Canu & Bassler's list of stations at which the species was obtained.

Generic Position.—It is not clear why Canu & Bassler referred this species to *Aplousina*, a genus which, according to their definition, is without avicularia. The avicularia of *A. tuberosa* are not mentioned in the original description of the species, but two are well shown in one of the figures (fig. 4) and, in another paper published in the same year (Canu & Bassler, 1928 b, p. 60), *A. errans* is distinguished from *A. tuberosa* by the absence of the " grandes zoécies aviculaires." These vicarious avicularia, which are to be seen in the colony sent to the British Museum by Professor Bassler (32.3.7.95, Gulf of Mexico, Alb. St. D. 2387), are the same size as the zoecia. The mandible is hinged to pivots at about the middle of the cell, and is spatulate, with slightly incurved sides. There is a well-marked oral shelf.

The avicularia are thus very much like those of some species of *Crassimarginatella*, and, indeed, the whole appearance of the species suggests that genus. Canu & Bassler described the ovicells as endozoecial, and if they are right the species is excluded from *Crassimarginatella*. My own conclusion, after examination of the British Museum specimen, is, however, that they are hyperstomial. The ovicells are broad and very shallow, and closed by the zoecial operculum, but I can find no

evidence at all that they are immersed in the distal zoecium.

I therefore conclude that *Aplousina tuberosa* should be transferred to *Crassimarginatella*. It is excluded from *Callopora* Gray, into which Calvet put *Membranipora filum* (see below), by its vicarious avicularia and the absence of pore-chambers.

Synonymy.—It seems likely that *Crassimarginatella tuberosa* is synonymous with *Membranipora filum* Jullien, which would have priority, and with part of *Biflustra lacroixii* Smitt.

As noted above (p. 82), Smitt's figures probably represent three species. The one shown in figures 85 and 86 closely resembles *Crassimarginatella tuberosa* in its zoecia and ovicells. Avicularia are not mentioned, and the little tubercles were overlooked, if present. In the British Museum specimen of *C. tuberosa* the tubercles are variable and may be very inconspicuous, and the avicularia, being of the same size and shape as the zoecia, would also be fairly easily overlooked with a low magnification. The discrepancies are thus not very serious, and as both forms were recorded from Florida the synonymy is very probable.

Jullien gave all four of Smitt's figures in the synonymy of *Membranipora filum*, but figs. 85 and 86 seem to bear the most resemblance to his figure. Canu & Bassler considered that *M. filum* differed from *Crassimarginatella tuberosa* in the absence of ovicells and in certain small differences in the "mural rim" which seem unimportant, particularly if the comparison is only based on Jullien's figure. The absence of ovicells in *Membranipora filum* is not proved, and the presence of large rounded vicarious avicularia in both species is a point in common. Unfortunately we do not know the exact shape of the avicularia of *M. filum*, which were described by Calvet in a footnote to the original description. The two little spine-like structures in the figure of *M. filum* might well be intended to represent the tubercles of *Crassimarginatella tuberosa*.

In his second footnote to Jullien's original description of *M. filum*, Calvet stated that the Corsican species identified by him with *Membranipora reticulum* (Linn.) belonged to *M. filum*. As he did not mention this in his later work (1931) he presumably changed his opinion.

Ellisina Norman.

Ellisina Norman, 1903, p. 596.

Ellisinidra Canu & Bassler, 1933, p. 18.

Genotype.—*Membranipora levata* Hincks, 1882.

Norman introduced the genus *Ellisina* with *Membranipora levata* Hincks (1882, pp. 249, 467) as genotype. Comparison of the type-specimen of *M. levata* (86.3.6.3) * from the Queen Charlotte Islands with Norman's material from the Gulf of St. Lawrence (11.10.1.621) has shown that Norman's material was wrongly identified, and that the characters attributed to *Ellisina* by Norman are those of his own material and not those of Hincks's species (Hastings, 1930, p. 713). In 1930 I concluded that *M. levata* Norman *nec* Hincks should be regarded as the genotype of *Ellisina*. On the strength of this Canu & Bassler (1933 p. 18) introduced *Ellisinidra* with *Membranipora levata* Hincks as genotype. I recognize now, however, that I was wrong in concluding that *M. levata* Hincks was not the genotype. A genotype explicitly named in the introduction of a genus must stand despite any such discrepancies in the definition. Thus *Ellisina* and *Ellisinidra* have the same genotype, and are absolute synonyms.

Norman's definition, being based on a species differing from the genotype in important particulars, needs alteration. My definition of *Ellisina* is: *Zooecia* membraniporine, ovicells endozooecial and closed by the zooecial operculum, avicularia vicarious and pointed, pore-chambers present. *Membranipora incrustans* Waters and the new species described on p. 94 belong to *Ellisina* as defined here. It appears that the ovicell may be immersed in a kenozoecium (*E. levata*), a vicarious avicularium (*E. antarctica*, sp. n.), or an autozooecium (*E. incrustans*).

The difference in the nature of the individual in which the endozooecial ovicell is immersed does not, I think, constitute a generic difference. In *Spiralaria denticulata* (Busk), for example, the ovicells in the same branch may be immersed in an avicularium or a kenozoecium. Both types are shown in the figure given by Busk (1852,

* This small specimen is the sole representative of the species in the British Museum,

pl. lvii. fig. 1). The kenozoecium in this instance has a membranous aperture, and only differs from an avicularium in the absence of a mandible. *Micropora brevissima* (Waters, 1904, p. 40)* affords another example of an endozoecial ovicell which may be immersed in a kenozoecium. The kenozoecium has a small aperture at its distal end and is connected with the surrounding zoecia by pore-chambers. Levinsen (1909, p. 58) discussed endozoecial ovicells imbedded in heterozoecia, and figured basal views showing the pore-chambers of the kenozoecium enveloping the ovicell in *Haplopoma impressum* (Audouin, Levinsen, 1909, p. 280, pl. xviii. fig. 11 a) and *Trypostega venusta* (Norman, Levinsen, 1909, pl. xix. fig. 1 b).

Norman included four species, besides the genotype, in *Ellisina*, namely:—*M. albida* Hincks (1880, p. 81), *M. coronata* Hincks (1881 a, p. 147), *M. minuscula* Hincks (1882, p. 469), and *M. incrustans* Waters (1898, p. 686). Of these, only *E. incrustans* remains in Norman's genus, the others having been placed elsewhere.

Harmer (1926, p. 264) transferred *Membranipora coronata* to *Setosellina* Calvet, and Canu & Bassler (1933, p. 16) made it the genotype of a new genus *Cranosinu* which has been accepted by Osburn (1940, p. 363). One of the figures given by Canu & Bassler (1929, pl. vii. fig. 9) clearly shows three zoecia of a kind that I suppose to be fertile. They are chiefly distinguished by their opercula, which are broader than those of the other zoecia and differ in shape (fig. 4); in addition, the smooth distal margin of the aperture is very slightly raised and hooded. The final proof that they are fertile zoecia can only be obtained from spirit material in which the internal anatomy can be examined. My material † is unfortunately all dry. In the piece decalci-

* Marcus (1921, p. 100), having demonstrated the variability of the species of *Micropora*, suggested that *M. brevissima* might be a synonym of *M. coriacea* (Esper). There is good material of *M. brevissima* in the collections of the 'Discovery' expedition, and I am satisfied that the two species are distinct.

† I have examined the following specimens, all of which have fertile zoecia as described here:—Ceylon, 1936.12.30.10 (see Thornely, 1905 and 1906); Singapore, 28.9.13.28 (see Harmer, 1926); New Guinea, 28.3.6.77, 78 (see Harmer, 1926); Philippines, 31.12.30.26 (see Canu & Bassler, 1929); Murray Island, Torres Straits, 90.3.24.71 (see Kirkpatrick, 1890 a); Great Barrier Reef, 32.4.20.111 (see Hastings,

fied for examination of the opercula, most of the zoecia are empty, but in two of the supposed fertile zoecia there is a mass with the characteristic appearance of a dried egg or embryo. I think there can be little doubt that these zoecia are fertile.

Harmer, who described *C. coronata* as probably without ovicells, found one embryo in his material but did not mention the difference between the fertile and non-fertile zoecia which is, however, to be seen in the Siboga specimens in the British Museum.

As these zoecia are shown in Canu & Bassler's figure and are present in the portion of their material in the British Museum, the raised distal part is presumably the structure regarded by these authors as a small endozoecial ovicell, but if it is a reduced ovicell, I do not think it is endozoecial*.

It appears then that *Cranosina* and *Ellisina* differ in their fertile zoecia, but that the character of the ovicells is probably not as stated in the definitions framed by Canu & Bassler (1933, pp. 16, 18) †.

Hastings (1930, p. 713) retained *M. albida*, together with *M. curvirostris* and *M. falcata*, in *Ellisina* "for the present," but noted that the operculum does not close the ovicell, whereas it does close it in *M. levata* Hincks. Osburn (1940, p. 360) introduced a new genus, *Parellisina*, for these species and certain others, choosing *M. curvirostris* as genotype. The observation that the ovicell of *Ellisina* is endozoecial, while that of *Parellisina* is hyperstomial, further supports Osburn's conclusions.

* If an endozoecial ovicell were present it would be immersed in a heterozomecium, as this is constantly the unit distal to the zoecium.

On the view that an avicularium is distinguished from a vibraculum by its symmetrical base (Waters, 1913, p. 481; Hastings, 1943, pp. 325, 335) these heterozomecia are avicularia.

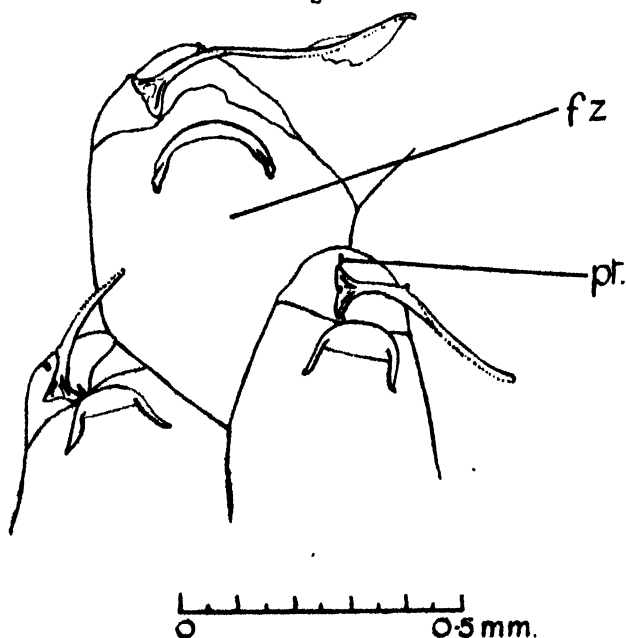
† I think Harmer was right in removing *C. coronata* from the Membraniporidae. In particular the structure of the chitinous parts suggests this conclusion, but the question of the systematic position of the genus *Cranosina* is outside the scope of this paper.

1932). The Barrier Reef specimen has lost its soft and chitinous parts, but some of the zoecia show the slightly raised distal margin.

The type-specimens of *Membranipora (Cranosina) coronata* Hincks, "Singapore or Philippines" (99.5.1.566), and *Membranipora hastilis* Kirkpatrick, China Sea (89.6.21.62) = *Cranosina coronata*, are not available at present, and the specimen from Lifu, Loyalty Islands (25.9.13.29), is also stored.

Silén (1942, p. 36) referred two species to *Ellisina*. Of these, *E. latirostris* Silén should clearly now be transferred to *Parellisina*. The position of *Ellisina canui* (Sakakura) is less obvious, but the characters of the ovicell distinguish it from *Ellisina* as defined here.

Fig. 4.



Cranosina coronata (Hincks), Ceylon, Thornely, 1936.12.30.10. Decalcified specimen, stained with picric acid, showing the two types of zoecia. One mandible has the rachis complete and retains shreds of the wing. The other two mandibles have the rachis truncated and have entirely lost the wing. One of the mandibles is displaced, uncovering the chitinized pivots, which are visible in all three avicularia.

The irregularity of the outline of the avicularian chamber distal to the fertile zoecium is due to distortion, but the position of the chamber, further from the orifice of the zoecium than in the non-fertile zoecia, appears to be typical.

f.z., fertile zoecium ; pt., chitinized pivot.

Membranipora minuscula Hincks, the fifth species included in *Ellisina* by Norman, has been put into *Hincksina* Norman (see O'Donoghue, 1926, p. 76). This attribution may need reconsideration, but in any case,

the rounded distally directed avicularia exclude the species from *Ellisina*, as I understand it. The attribution to *Hincksina* implies the absence of pore-chambers, which would be a further point of difference. The only specimen of this species in the British Museum (Hincks Coll. 99.5.1.604) is at present stored for safety, and is not accessible.

Key to the Species of Ellisina discussed here.

- | | |
|---|--------------------------------|
| 1. Ovicell with avicularium distal to it..... | 2. |
| Ovicell without distal avicularium..... | 3. |
| 2. Ovicell umbonate, immersed in avicularium | 2. <i>E. antarctica</i> . |
| Ovicell with clavate ridge, relation to avicularium unknown | <i>E. sericea</i> , see p. 98. |
| 3. Ovicell umbonate, immersed in kenozoecium, cryptocyst narrow | <i>E. levata</i> , see p. 98. |
| Ovicell with smooth frontal band, immersed in distal zoecium, cryptocyst wide | 1. <i>E. incrustans</i> . |

1. *Ellisina incrustans* (Waters). (Fig. 5.)

Membranipora incrustans Waters, 1898, p. 686, pl. xlvii. fig. 13.

Membranipora incrustans (part) Waters, 1904, p. 31 (not pl. ii. fig. 15 a, b, c).

Ellisina incrustans Norman, 1903, p. 596.

Membranipora coronata Jullien, 1898, p. 76 (not *M. coronata* Hincks).

Membranipora dumerilii Waters, 1889, p. 12 (not *M. dumerilii* Audouin).

Membranipora watersi (part) Kluge, 1914, p. 659.

Distribution.—Inaccessible Island, Tristan da Cunha, 137 m., 'Challenger' St. 135 a (Waters; Manchester Museum; Cambridge Museum); Nightingale Island, Tristan da Cunha, 201–274 m., 'Challenger' St. 135 c (Cambridge Museum); Cape Horn, on weed (Jullien); Patagonian Shelf, 76–162 m. ('Discovery' Investigations, Sts. WS 85, WS 88, WS 221, WS 225 *).

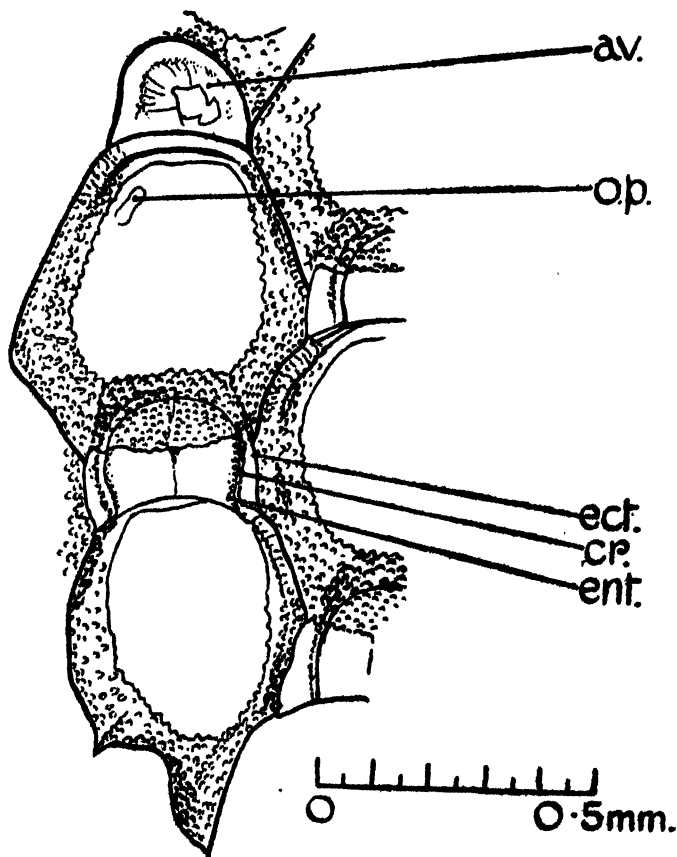
Holotype.—'Challenger' St. 135 a, Inaccessible Island, Tristan da Cunha (87.12.9.313), not recorded in Busk's 'Challenger' Report.

Description.—The 'Discovery' specimens agree very exactly with the type-material of Waters's species. The zoecia (fig. 5) are more or less oval, with little or no visible frontal gymnocyst. The cryptocyst is strongly tuberculated and a little wider proximally. Two or three

* Particulars of the stations of the 'Discovery' Investigations are to be found in the published Station Lists. The stations of the National Antarctic Expedition are given in my 'Discovery' Report (Hastings, 1943, p. 316), where those of the 'Discovery' are also summarized.

pore-chambers are present on each side, but a distal one has not been seen. Some zoecia have a pair of small, oval, less calcified patches in the distal part of the basal

Fig. 5.



Ellisina incrustans (Waters). 'Discovery' St. W886. Non-fertile zoecium, avicularium, fertile zoecium and parts of neighbouring zoecia, including two ovicells, after treatment with eau de javelle.

av., avicularium; cr., cryptocyst; ect., ectozoecium; ent., entozoecium; o.p., oval patch.

wall, but these are not constant (one is visible in fig. 5, o.p.). The avicularia are vicarious and connected with neighbouring zoecia by pore-chambers. The avicularian

chamber projects frontally, and the mandible, which is pointed, is directed obliquely or almost transversely.

The ovicells are endozoöcial and covered by the cryptocyst of the distal zoöcium. The ectocyst is also partly calcified forming a smooth broad border with a median suture. The distal edge of this band is serrated. In transparent preparations the three calcareous layers of which the ovicell consists in the region of this band can readily be distinguished (fig. 5, *ect.*, *cr.*, and *enl.*), the cryptocyst showing beside the ectoöcium where the contours bring them into optical section. The cryptocyst, which is coarsely granular where the ectocyst is membranous, is smooth in this part. The proportions of the parts of the ovicells vary. The cryptocyst of the distal zoöcium may be narrower than in the ovicell figured so that the top of the ovicell can be seen through the frontal membrane projecting beyond the edge of the cryptocyst. The calcareous part of the ectoöcium may cover nearly the whole of the frontal surface so that the ovicell appears smooth with a median suture, as described by Kluge, or it may be narrower, leaving a considerable area of the granular cryptocyst visible in frontal view. In this condition the ovicell resembles that of *M. constantia* Kluge (1914, p. 661). I have not seen Kluge's species, which appears to be related to *E. incrustans*, but differs in its narrower, more finely granular, zoöcial cryptocyst, which is convex, not descending.

Synonymy.—The type-material of this species from 'Challenger' St. 135 *a*, was identified by Busk as *Membranipora crassimarginata* var. *incrustans*, but is not mentioned in his report (Busk, 1884, p. 63), which only gives St. 135 *c*. The material from St. 135 *c* agrees with Busk's figure and description of var. *incrustans* (= *Crassimarginatella exilimargo* Canu & Bassler) and is specifically distinct from that from St. 135 *a*. Misled by Busk's wrong determination, Waters introduced the name *Membranipora incrustans* for the species from St. 135 *a*. This was, as pointed out by Harmer (1926, p. 224), a valid introduction of a new species, and Kluge's introduction of *M. watersi* as a new name for *M. incrustans* Waters was thus unnecessary*.

* The Cambridge Museum possesses a slide of *Ellisia incrustans* (Waters) from each of the two stations, 135 *a* and 135 *c*.

Ellisina incrustans was only obtained by the 'Discovery' Expedition in the Patagonian region and at Tristan da Cunha. Farther south, but extending into the Patagonian Region, another species was obtained, described below as *E. antarctica*. *E. antarctica* differs from *E. incrustans* in its ovicells (see key), its larger and more prominent avicularia, its mostly uncalcified basal wall, and its narrower, smoother cryptocyst.

Waters described the avicularia of his supposed material of *E. incrustans* from the Bellingshausen Sea as being larger and more prominent than those of the typical form, and it therefore seems likely that he had *E. antarctica*. He does not mention the ovicells which are the feature by which the two species are most strikingly distinguished.

Waters also described a variety of *E. incrustans* from the Bellingshausen Sea. A specimen showing similar peculiarities and coming from the same region as Waters's variety resembles *E. antarctica* rather than *E. incrustans* (see p. 97).

Kluge briefly described the ovicells of his specimens, but did not mention any feature characteristic of either species. He stated that his specimens agreed with those from the 'Belgica' (i. e., Waters's), which I believe he examined, and it may therefore be presumed that they belonged to the same species, which, as just explained, may be *E. antarctica*.

No information is available about Calvet's specimen from the Bellingshausen Sea. It seems likely, however, that a specimen from that locality would belong to *E. antarctica* rather than to *E. incrustans*.

2. *Ellisina antarctica*, sp. n. (Fig. 6.)

? *Membranipora incrustans* (part) Waters, 1904, p. 31, pl. II, fig. 15 a.

? *Membranipora incrustans* Calvet, 1909, p. 14.

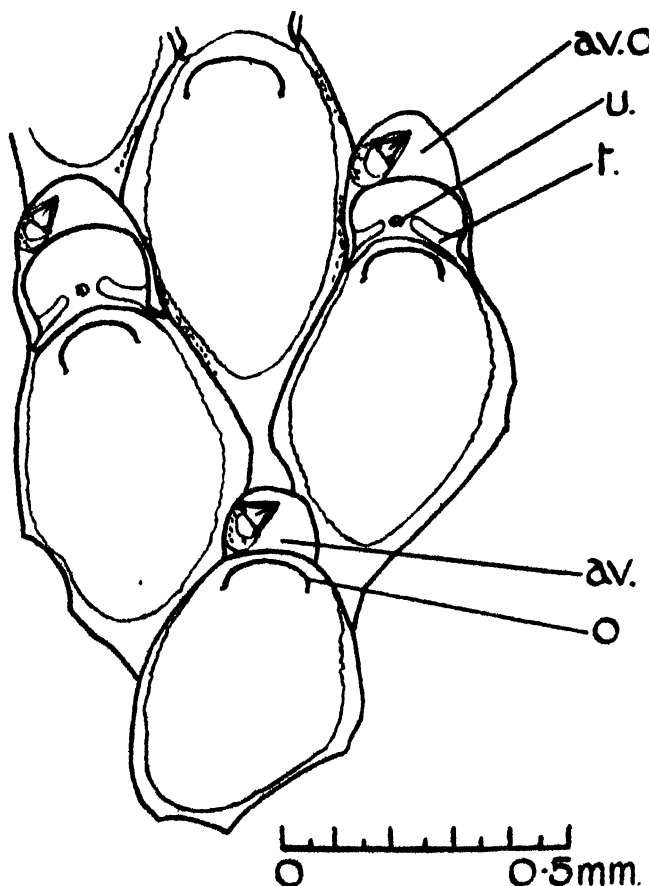
? *Membranipora watersi* (part) Kluge, 1914, p. 659.

Distribution.—Patagonian Shelf, 96–144 m. ('Discovery' Investigations, Sts. WS 87, WS 243, 1942.5.10.16, 14); Falkland Islands, 75–74 m. ('Discovery' Investigations, St. WS 84, 1942.5.10.10); Heard Island *, 274.5 m. ('Challenger,' St. 150, 87.9.2.3); South Georgia, 110–

* Specimen left unnamed by Busk.

342 m. ('Discovery' Investigations, Sts. 27, 170, WS 33, 1942.5.10. 7, 13, 8); South Sandwich Islands, 77-152 m. ('Discovery' Investigations, St. 366, 1942.5.10.6 and

Fig. 6



Ellisma antarctica, sp. n. Two fertile zoecia and one non-fertile zoecium with their distal vicarious avicularia, and part of a third fertile zoecium.

av., avicularium; av.o., avicularium enveloping ovicell;
o., operculum; t., calcified tongue; u., umbo.

1943.8.4.1); South Orkney Islands, 24-36 m. ('Discovery' Investigations, St. 164, 1942.5.10.11); near

Elephant Island, 342 m. ('Discovery' Investigations, St. 170, 1942.5.10.12); South Shetland Islands, 391 m. ('Discovery' Investigations, St. 195, 1942.5.10.9); ? Bellingshausen Sea, 20-30 m. and 485-480 m. (Calvet; Waters); ? Wilhelm II. Land, 385 m. (Kluge); Cape Adare, 32.9 m. (National Antarctic Exp., 1942.5.10.5); McMurdo Sound, 45.7-54.9 m. (National Antarctic Expedition, No. 12 Hole, 1942.5.10.15)*.

Holotype.—South Sandwich Islands, 1943.8.4.1.

Description.—*Zoarium* encrusting, rather delicate.

Zoecia (fig. 6) with more or less oval aperture, with very narrow, slightly granular cryptocyst extending along sides and round proximal end of aperture, pore-chambers present, basal wall uncalcified except at its periphery.

Avicularia small, vicarious, placed distally to the zoecia, connected with neighbouring zoecia by pore-chambers, basal wall incompletely calcified. Mandible acutely triangular, directed obliquely.

Ovicells endozoecial, immersed in distal avicularium, closed by zoecial operculum, with small frontal umbo, and, when fully formed, with a pair of smooth and very inconspicuous calcareous tongues curving across front apparently between ectozoecium (= wall of avicularium) and entozoecium.

Ancestrula almost circular, with circular aperture, and slight proximal gynocyst. Aperture surrounded by a few (about 6 or 7), widely spaced, erect spines.

Remarks.—The cryptocyst in this species is only recognizable as such by analogy with related species. The material from the type-locality consists of numerous colonies on weed †, some of them with their ancestrulae intact. The first-formed zoecia, like the ancestrula, have widely spaced spines round the aperture. Successive zoecia have fewer spines, the great majority having none. The last spines retained are placed one on each side at a little distance from the distal end of the zoecium. These two spines are sometimes pointed, and may appear brown and membranous at the tip or calcareous throughout. Two similarly placed spines are present on one zoecium in a colony from Cape Adare.

* See footnote, p. 91.

† Colonies from other localities may have other substrata, e. g., stones and other *Polyzoa*.

The colonies from the Falkland Islands and the Patagonian Shelf have no ovicells, but agree so closely with the Antarctic specimens in their other features that they are referred to the same species.

Zoecia are sometimes found with a calcareous frontal closure, which may be complete, or may leave a small median pore.

The edge of the calcified part of the basal wall can often be seen, in transparent mounts, as a smooth line just within the very slightly crenulated margin of the cryptocyst and at a lower focus.

Synonymy.—The reasons for supposing that *Ellisina antarctica* may be the Antarctic species referred, by Waters and other authors, to *E. incrustans* (Waters) are given above (p. 94). *E. antarctica* differs from *E. incrustans* in its larger, more prominent avicularia, in its mostly uncalcified basal wall, in its narrower cryptocyst, in the different sculpture of the ovicell, and in the immersion of the ovicell in an avicularium. The 'Belgica' material is not represented in the Waters Collection at Manchester, and I have not been able to examine any of it.

E. antarctica differs from *E. levata* Hincks (1882, pp. 249, 467) in the smaller umbo on the ovicell, and in the ovicell being immersed in an avicularium. It appears, however, that the fenestra distal to the ovicell of *E. levata* (see Hastings, 1930, pl. viii. fig. 34) is the opesia of a kenozoecium similarly enveloping the ovicell. The two species are thus very closely allied. Spines have not been recorded in *E. levata*.

In a specimen of *Ellisina* taken by the British Graham Land Expedition (1942.5.12.1) the zoecia are a little larger than in the typical specimens of *E. antarctica*, the cryptocyst is a little wider and distinctly granular, and the avicularia enveloping the ovicells are frequently, but not always, directed distally. This may be the form figured by Waters (1904, p. 31, pl. ii. fig. 15 b, c) as *Membranipora incrustans* var. *grandis*. In Waters's figure, however, the distally directed avicularium has a more acutely pointed mandible, and is not related to an ovicell.

A colony of *Ellisina* from New Zealand ('Terra Nova' Expedition, St. 91, 1945.5.2.1) agrees with *E. antarctica* in its zoecia, but has no unbroken ovicell. According to

MacGillivray's figure, *E. (Biflustra) sericea* (MacGillivray, 1890, p. 107) only differs from *E. antarctica* in the sculpture on the front of the ovicell which takes the form of a clavate ridge instead of an umbo. Thus, in the absence of a complete ovicell it is not possible to settle whether the New Zealand specimen belongs to *E. sericea* or *E. antarctica*. At the margin of the colony from New Zealand there are a number of vicarious avicularia of the same size and shape as those distal to the zoecia, but without corresponding zoecia.

Waters (1898, p. 687) regarded *E. sericea* as a synonym of *E. levata*, but it differs in the sculpture of the ovicell and the presence of an avicularium above the ovicell. All three species appear to be very closely related, but I have not found any intergradation in their characters (cf. key, p. 91), and their distribution, as at present known, is not continuous, *E. sericea* being found in Australia, *E. levata* at the Queen Charlotte Islands, and *E. antarctica* in the Antarctic and sub-Antarctic regions. There is a small specimen from Oran, North Africa (Waters Collection, Manchester Museum), which I examined a good many years ago, and noted as resembling *E. antarctica*. It is labelled "*Membranipora, see dumerilii*."

Acanthodesia Canu & Bassler.

Acanthodesia Canu & Bassler, 1919, p. 79.

Acanthodesia perfragilis (MacGillivray).

Biflustra perfragilis MacGillivray, 1881, p. 27, pl. lvn, fig. 1.

Membranipora perfragilis Waters, 1898, p. 689, pl. xlvii, figs. 15-17 (synonymy); 1924, p. 605.

[Genus ?] *perfragilis* Harmer, 1926, p. 224.

? Not *Amphiblestrum perfragile* Ortmann, 1889, p. 29.

Membranipora crassimarginata var. *erecta* Busk, 1884, p. 63, pl. xiv, figs. 3, 3 a.

Distribution.—Port Phillip Heads; King Island, Bass Straits (Macgillivray); East Monocour Island, Bass Straits, 70-156 m. (Busk); Heard Island, 137 m. (Busk).

Remarks.—Marcus (1921, p. 99) and Calvet (1931, p. 59) disputed the view that Busk's *Membranipora crassimarginata* var. *erecta* is a synonym of *Acanthodesia perfragilis* (MacGillivray=*Biflustra fragilis* MacG.), but examination of material in the British Museum fully confirms the opinion of Waters and Harmer, and shows

that the agreement of the Australian specimens of *A. perfragilis* and the 'Challenger' specimens of var *erecta* (including those from Heard Island) is very exact. The avicularia have no trace of projecting pivots, and this is not due to damage for, in both sets of specimens, the pivots are absent in transparent preparations in which the mandible is in position and the ectocyst is undamaged. The avicularian polypide consists of a small mass of tissue with a short tentacle-sheath, but no tentacles. There are a few muscle-fibres in the position of retractor muscles. The colony from Heard Island is bilaminar, erect and convoluted, and closely resembles MacGillivray's fig. 1.

Ortmann recorded this species as common at Maizuru, Japan. His specimens were without avicularia, and his brief description would apply equally well to *Acanthodesia savartii* (compare Harmer's description, 1926, p. 215), a common Japanese species which is not included in Ortmann's paper. I therefore hesitate to accept his record.

A. perfragilis differs from the species of *Crassimarginatella* discussed here in the complete absence of bar or pivots from the avicularia, in its escharan colony, and in the absence of ovicells. It shows considerable general resemblance to *Acanthodesia*, and it seems suitable to put the species tentatively into that genus.

Summary.

Membranipora (*Crassimarginatella*) *crassimarginata* Hincks is particularly characterized by its avicularia with a complete, calcareous, transverse bar. Its distribution appears to be limited, except for some Eocene and Miocene fossils, to the warmer parts of the North Atlantic and, probably, the Mediterranean (p. 73).

Membranipora marginalis Kirkpatrick is a species of *Crassimarginatella* distinguished from *C. crassimarginata* by its avicularia (p. 78).

Membranipora crassimarginata var. *japonica* Ortmann is a distinct species, *Crassimarginatella japonica* (Ortmann) (p. 79).

Waters and Harmer rightly considered that *M. crassimarginata* var. *erecta* belongs to *Biflustra perfragilis*

MacGillivray. It is tentatively referred to *Acanthodesia* Canu & Bassler (p. 98).

Waters showed that the 'Challenger' material labelled by Busk as *M. crassimarginata* var. *incrustans* comprised two species. Only one of them is included in Busk's report. It belongs to *Crassimarginatella exilimargo* Canu & Bassler (p. 79). Waters described the other species as *Membranipora incrustans*. It is now referred to *Ellisina* Norman (p. 91). A species, described here as *E. antarctica*, is probably the Antarctic form that has been referred to *Membranipora incrustans* by various authors (p. 94).

Aplousina tuberosa Canu & Bassler belongs to *Crassimarginatella*. It will probably prove to be a synonym of *Membranipora filum* Jullien, which would have priority (p. 86). *Biflustra lacroixii* Smitt, given in the synonymy of *Membranipora crassimarginata* var. *incrustans* by Busk, and of *M. filum* by Jullien, comprised more than one species. One of them is very probably *Crassimarginatella tuberosa* (pp. 86, 88).

The genotype of *Pyrulella* Harmer is essentially distinguished from that of *Valdemunitella* Canu only by the presence of well developed spines; and the other two species originally included in the genus are similarly related to *Crassimarginatella*. *Pyrulella* is thus regarded as a synonym of *Valdemunitella*, and the original species are distributed between that genus and *Crassimarginatella*. It is, however, probable that *Valdemunitella* itself is a synonym of *Crassimarginatella* (p. 69).

The genotype of *Ellisina* is *Membranipora levata* Hincks. The genus is redefined (p. 87). Several of the species originally referred to the genus have since been placed in other genera (p. 88).

Membranipora coronata Hincks, genotype of *Cranisina* Canu & Bassler, has fertile zoecia differing somewhat in shape from the non-fertile zoecia (p. 82).

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VI. *The Genera of the Gyrinoidea and their Genotypes.*
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A FEW of the genera of the Gyrinoidea have been found to be still without designated genotypes, and it has been thought worth while to have these fixed definitively and at the same time to include some short notes on some of the genera where a clarification of certain points seems desirable.

The preliminary notes are given first, among them the new genotype citations where required, and the following part of the paper gives the complete list of genera, citations of genotypes and synonyms; no attempt has been made to list the species of each genus although such a catalogue is now overdue owing to the large number of additional species described since the publication of Ahlwarth's Catalogue (Junk, Coleopt. Cat., Pars 21, 1910).

SYSTEMATIC NOTES.

Dineutus MacLeay (1825).

This genus was proposed by MacLeay for the large Javan Gyrinid named by him in the same volume (Annul. Jav. ed. 1, 1825: 30) *Dineutus politus* MacLeay. The genus has since been divided into ten subgenera, partly by Hatch (Pap. Mich. Acad. Sci. 5, 1925: 429-467) but principally by Ochs (Ent. Zeitschr. 40, 1926-27: 61-74, 112-126, 129-140, 190-197), who treats it very thoroughly. There is slight conflict between Ochs's studies and those of Hatch with regard to two subgenera.

Hatch (l. c. p. 447) uses the name *Cyclous*, ascribed to Eschscholtz, including twelve species in the subgenus. He does not designate a subgenotype. Eschscholtz's paper was unpublished and the name first appears in Dejean's Catalogue (2nd edition, 1833 : 58), where it must be treated as a *nomen nudum* according to Opinion 1 of the Rules of Nomenclature.

Hope (Col. Man. 2, 1839 : 145) gives, amongst a list of the genera included by him in the Gyrinoidea, a genus to which the three names *Enhydrus* Laporte (1835), *Cyclinus* Kirby (1837) and *Cyclous* Eschscholtz are given, the country of origin being "N. America" and the typical species named as "*G. australis* Fab.". That species is not named by either Laporte or by Kirby and, since Eschscholtz's genus was at that date a *nomen nudum*, Hope's citation is invalid.

Ochs shows that the basis of the subdivision proposed by Hatch is unsound and he transfers all the species named under *Cyclous* by Hatch, with the exception of *australis* Fabricius, to other subgenera, enlarging and altering the conception of *Spinosodineutes* Hatch to include a number of the species placed in *Cyclous* by that author. Ochs also designated *Gyrinus australis* Fabricius as the subgenotype of *Cyclous* (Hatch) Ochs. Since no effective citation of a subgenotype for *Cyclous* had been made at the date of Ochs's publication his designation of that species is perfectly legitimate, his freedom of choice among the species originally included by Hatch being unrestricted. He properly ignores a previous mention of *Cyclous* by Hatch (Bull. Brooklyn Ent. Soc. 20, 1925 : 110), where, in a key to the known larvæ of the family Hatch names only *unidentatus* Aubé as being known in that subgenus, this clearly not being a citation of a subgenotype. *Gyrinodineutus* Ochs, created on an earlier page of Ochs's paper, is not actually stated to be synonym of *Spinosodineutus*, but the implication is perfectly clear that Ochs appreciated the synonymy. He named as subgenotype *Dineutes unidentatus* Aubé (1838).

***Enhydrus* Castelnau (1835).**

This genus was created by Castelnau (Etud. Ent. 2, 1835 : 110) for *Gyrinus sulcatus* Wiedemann (1821). It was accepted by Régimbart (Ann. Soc. ent. France (6) 2,

1882 : 393) as the type genus of the subfamily *Enhydrinæ* and has been so accepted ever since. It would, therefore, be in the highest degree unfortunate if it were necessary to change the name and I am proposing, in view of what follows, to submit an application to the International Commission on Zoological Nomenclature that the Rules be suspended and that *Enhydrus* Castelnau (1835) be added to the Official List of Generic Names and that *Enhydrus* Rafinesque (1815) is not to be used.

According to Neave (Nomencl. Zool. 2, 1939 : 234) *Enhydrus* Castelnau (1835) appears to be twice preoccupied, *Enhydrus* Rafinesque (1815) and *Enhydrus* MacLeay (1825) antedating the publication by Castelnau. On investigation *Enhydrus* Rafinesque appears to be either an unnecessary emendation or an error in transcription of *Enhydria* Latreille (1801). This spelling appears to have been used but once.

Enhydrus MacLeay is found to be credited to Megerle and is accompanied neither by bibliographic reference nor diagnosis and, by comparison with new genera described in the same volume, was clearly not used by MacLeay in the sense of a new genus. Neave gives "Megerle (MS.) Dahl, 1823, Col. und Lepid., 34 (n. n.)" and Dahl's publication was but a price list without any diagnosis of genera. *Enhydrus*, in Dahl's list, credited to Megerle, includes a number of species now in *Enochrus*, *Helochares*, *Paracymus*, *Anacæna* and *Chætarthria*, and it seems certain that MacLeay was following the same use of the name, his species (*pallens*) being now an *Helochares*; it will follow, as Dahl's list is of no nomenclatorial value, that MacLeay's *Enhydrus* if the name must also constitute a *nomen nudum*.

Enhydrus Castelnau has, therefore, but the single use of *Enhydrus* Rafinesque to contend with; in view of the fact that the latter has never been in use since Rafinesque's unfortunate error of transcription or unnecessary emendation whereas *Enhydrus* Castelnau has been in continuous use and, indeed, made the type genus of the subfamily *Enhydrinæ*, there appears to be sufficient reason to submit an application to the International Commission for an Opinion that *Enhydrus* Castelnau (1835) be accepted as a valid name and included in the Official List of Generic Names.

If the International Commission should reject the application it will be necessary to have a new name for this genus and the subfamily. In that case *Epinectus* (Eschscholtz) Aubé (Spec. Col. 6, 1838: 651) appears to be available. The name was originally published in Dejean (Cat. Col. ed. 2, 1833: 58) and is therefore a *nomen nudum* as of that date but it is given by Aubé as a synonym of *Enhydrus* Laporte, ascribed to Eschscholtz; Aubé's inclusion of it fortunately validates it and it will take the same genotype as *Enhydrus* Castelnau. *Epinectes* Régimbart (1877) (emendation) is a simple synonym. If it is necessary to use *Epinectus* the name of the subfamily will become *Epinectinae*.

Andogyrus Ochs (1924).

This genus was created for the South American species of *Macrogyrus* Régimbart. The species included, although very closely related to *Macrogyrus*, are sufficiently distinct to justify the creation of the genus. No genotype was designated by Ochs, nor does any subsequent citation appear to have been made and accordingly I here designate as type *Enhydrus ellipticus* Brullé (1835).

Macrogyrus Régimbart (1882).

Macrogyrus was created by Régimbart (Ann. Soc. ent. France (6) 2, 1882: 432) for those Australian and South American species till then included in *Enhydrus* Castelnau with the exception of *sulcatus* Wiedemann, *atratus* Rég., and *tibialis* Rég. The South American species were later separated as *Andogyrus* Ochs (*supra*). No genotype was designated by Régimbart, nor did Ochs select a type when separating *Andogyrus*, nor, later, when creating the subgenera *Cyclomimus* Ochs (1929) and *Orectomimus* Ochs (1930) did he select a type of *Macrogyrus* s. str. Ochs. I therefore here name as genotype of *Macrogyrus* Régimbart *Enhydrus howittii* Clark (1863).

Aulonogyrus Régimbart (1883).

Ochs (Cat. Ind. Ins. Part 19, 1930: 3) credits the genus to Motschulsky (Hydrocanth. Russ. 1853: 9) and gives a citation of *Gyrinus concinnus* Klug (1834) (= *striatus* Motschulsky, *strigipennis* Suffr.) as genotype. F. Balfour-Browne (Ent. Mon. Mag. 72, 1936: 97), apparently unaware of the previous citation of Ochs, selected *Gyrinus striatus* Fabricius (1792) as type of *Aulonogyrus* Régimbart.

The publication of the name *Aulonogyrus* by Motschulsky is made in a Catalogue list of the Hydradephaga of Russia and is unaccompanied by any indication, diagnosis or description, being followed only by two specific names, "*striatus* F." and *strigipennis* Suffr., but the *striatus* of Motschulsky is not that of Fabricius but that of Aubé, which is a synonym of *concinus* Klug, as is also *strigipennis* Suffr. The publication of the name by Motschulsky is not, however, valid according to Opinion 1 of the Rules of Nomenclature and it constitutes a *nomen nudum*. Régimbart was, therefore, perfectly entitled to make use of the name at a later date and his publication is the valid one. The citation of *Gyrinus concinns* Klug as genotype by Ochs was apparently based on selection by monotypical designation of Motschulsky. That that author's name is not available nomenclatorially might be a sound basis for the rejection of the citation, but it appears to me that this view should not be accepted. Ochs does not state, in so many words, that he selected the type by monotypical designation and, as the species is included among those named as being in *Aulonogyrus* by Régimbart, Ochs's selection should be allowed to stand. The citation of F. Balfour-Browne must therefore be set aside and the type of *Aulonogyrus* Régimbart will be *Gyrinus concinns* Klug.

***Orectogyrus* Régimbart (1883).**

This genus was created for the African and Madagascan species at that time included in *Orectochilus* Stephens, which genus was supposed by Régimbart to be wholly unrepresented in tropical Africa. There is actually a single species, *Orectochilus africanus* Ochs (1923), found in the Congo region, but *Orectogyrus* is undoubtedly a well-founded genus. No type appears to have been selected at any time and accordingly I here designate as genotype *Orectogyrus cuprifer* Régimbart (1883).

LIST OF GENERA AND GENOTYPES.

1. Enhydrinæ Régimbart.

A. DINEUTINI Ochs.

1. *Dineutus* MacLeay, 1825.

MacLeay, *Annul. Javan.*, edition 1, 1825 : 30.

Type (only species named by MacLeay) = *Dineutus politus* MacLeay (1825).

Synonyms :—*Dineutes* auctt. emendation; *Necticus* Castelnau (1835).

Subgenera :—

a. Cyclinus Kirby, 1837.

Kirby, in Richardson's Fauna Bor.-Amer. 4, 1837 : 78.

Type (only species named by Kirby) = *Cyclinus assimilis* Kirby (1837) = *Gyrinus americanus* Linnaeus (1788).

No synonyms.

b. Cyclous (Hatch, 1925), Ochs, 1926.

Hatch, Pap. Mich. Acad. Sci. 5, 1925 : 447.

Ochs, Ent. Zeitschr. 40, 1926 : 65, 196.

(Echscholtz, (MS.) in Dejean, Cat. Col. ed. 2, 1833 : 58.)

Type (fixed by Ochs, 1926) = *Gyrinus australis* Fabricius (1775).

No synonyms.

c. Paracyclous Ochs, 1926.

Ochs, Ent. Zeitschr. 40, 1926 : 65.

Type (fixed by Ochs, 1926) = *Dineutes ritsemai* Régimbart (1882).

No synonyms.

d. Callistodineutus Ochs, 1926.

Ochs, Ent. Zeitschr. 40, 1926 : 65.

Type (fixed by Ochs, 1926) = *Dineutes fairmairei* Régimbart (1882).

No synonyms.

e. Rhombodineutus Ochs, 1926.

Ochs, Ent. Zeitschr. 40, 1926 : 65.

Type (fixed by Ochs, 1926) = *Dineutes neobritannicus* Ochs (1925).

No synonyms.

f. Spinosodineutes Hatch, 1925.

Hatch, Pap. Mich. Acad. Sci. 5, 1925 : 447.

Type (fixed by Hatch, 1925) = *Gyrinus spinosus* Fabricius (1781).

Synonyms. - (*Cyclous* Hatch, 1925 *partim*; *Gyrinodineutus* Ochs, 1926 (Type, fixed by Ochs, 1926=*Dineutus unidentatus* Aubé (1838))).

g. Protodineutus Ochs, 1926.

Ochs, Ent. Zeitschr. **40**, 1926 : 66, 137.

Type (fixed by Ochs, 1926)---*Dineutes arvens* Klug (1834).

No synonyms.

h. Rhomborhynchus Ochs, 1926.

Ochs, Ent. Zeitschr. **40**, 1926 : 65.

Type (fixed by Ochs, 1926)=*Dineutes depressus* Régimbart (1892).

No synonyms.

j. Porrorhynchus Castelnau, 1835.

Castelnau, Etud. Ent. **2**, 1835 : 108.

Type (only species named by Castelnau)=*Porrorhynchus marginatus* Castelnau (1835).

No synonyms.

k. Dineutus MacLeay (subgen. typ.).

Hatch, Pap. Mich. Acad. Sci. **5**, 1925 : 447.

B. ENHYDRINI Ochs.

2. Enhydrus Castelnau, 1835.

Castelnau, Etud. Ent. **2**, 1835 : 110.

Type (only species named by Castelnau)=*Gyrinus sulcatus* Wiedemann (1821).

Synonyms :- *Epinectus* (Ernscholtz MS.) Aubé, 1838 (Type, only species named by Aubé, 1838=*Gyrinus sulcatus* Wiedemann (1821)); *Epinectes* Régimbart, 1877 emendation.

3. Andogyrus Ochs, 1924.

Ochs, Ent. Blatter, **20. Jahrg.** 1924 : 236.

Type (fixed by J. Balfour-Browne herein)=*Enhydrus ellipticus* Brullé (1835).

Synonyms :- *Andogyrus* Hatch (1925) emendation.

4. Macrogyrus Régimbart, 1882.

Régimbart, Ann. Soc. Ent. France (6) **3**, 1882 : 432.

Type (fixed by J. Balfour-Browne herein) = *Enhydrus howittii* Clark (1863).

Synonyms :—*Enhydrus* Brullé 1835 *partim*.

Subgenera :—

a. **Macrogyrus** Régimbart (subgen. typ.).

b. **Cyclomimus** Ochs, 1929.

Ochs, Ent. Blatt. 25 Jahrg. 1929 : 199.

Type (fixed by Ochs, 1929) = *Macrogyrus purpurascens* Régimbart (1882).

No synonyms.

c. **Orestomimus** Ochs, 1930.

Ochs, Ent. Blatt. 26 Jahrg. 1930 : 16.

Type (fixed by Ochs, 1930) = *Macrogyrus paradoxus* Régimbart (1882).

No synonyms.

II. *Gyrininae* Régimbart.

5. **Paragyrimus** Ochs, 1924.

Ochs, Ent. Blatt. 20 Jahrg. 1924 : 231.

Type (fixed by Ochs, 1930) = *Paragyrimus sinensis* Ochs (1924).

No synonyms.

6. **Gyrinus** (Geoffroy in) Müller, 1764.

Müller, Fauna Ins. Friedrichsdal. 1764 : xvii.

Type (only species named in Geoffroy, 1762) = *Dytiscus natator* Linnæus (1758).

No synonyms.

Subgenera :—

a. **Gyrinulus** Zaitzev, 1907.

Zaitzev, Horæ Soc. ent. Ross. 7, 1907 : 236.

Type (only species named by Zaitzev) = *Gyrinus minutus* Fabricius (1798).

Synonyms :—*Gyradelphus* Des Gozis, 1915 (type, fixed by Des Gozis, 1915 = *Gyrinus minutus* Fabricius (1798)).

b. **Neogyrimus** Hatch, 1925.

Hatch, Pap. Mich. Acad. Sci. 5, 1925 : 458.

Type (fixed by Hatch, 1925) = *Gyrinus chalybeus* Perty (1830).

No synonyms.

c. **Oreogyrinus** Ochs, 1935.

Ochs, *Rev. Ent. Rio de Janeiro*, 5, 1935 : 124.

Type (fixed by Ochs, 1935) = *Gyrinus parvus* Say (1834).

No synonyms.

d. **Gyrinus** (Geoffroy in) Muller (subgen. typ.).

7. **Aulonogyrus** Régimbart, 1883.

Régimbart, *Ann. Soc. ent. France* (6) 2, 1883 : 124.

Type (fixed by Ochs, 1930) = *Gyrinus canaliculatus* Kling (1834).

No synonyms.

III. **Orectochilinae** Régimbart.

8. **Gyretes** Brullé, 1835.

Brullé, in Audouin and Brullé *Hist. Nat. Ins.* 5, Col. 2, 1835 : 241.

Type (fixed by Brullé, 1835) = *Gyretes æneus* Brullé (1835) = *Gyrinus bidens* Olivier (1792).

No synonyms.

9. **Orectogyrus** Régimbart, 1883.

Régimbart, *Ann. Soc. ent. France* (6) 2, 1883 : 385, 439.

Type (fixed by J. Balfour-Browne herein) = *Orectogyrus cuprifer* Régimbart (1883).

10. **Orectochilus** Stephens (1833), 1835.

Stephens (*Syst. Cat. Brit. Ins.* 1833 : 20).—III. *Brit. Ent. Mand.* 5, 1835 : 395.

Type (only species named by Stephens, 1835) = *Gyrinus villosus* Illiger (1798) (=Müller, 1776).

Synonyms:—*Potamobius* Stephens, 1829, *nec* Samouelle, 1819.

Subgenera :—

a. **Orectochilus** Stephens (subgen. typ.).

b. **Patrus** Aubé, 1836.

Aubé, in Dejean & Boisdual *Icon. Col.* 5, 1836 : 397.

Hatch, *Pap. Mich. Acad. Sci.* 5, 1925 : 452.

Type (only species named by Aubé, 1836) = *Patrus javanus* Aubé (1836).

VI.—On some *Anthidiine* Bees (Apoidea) from Palestine.—

Part II. By G. A. MAVROMOUSTAKIS, Limassol, Cyprus.

THE bees described and recorded in this paper were kindly sent to me by Prof. H. Bytinski-Salz and Mr. J. Glimcher, Jerusalem, Palestine. The types of the new species and subspecies are in my collection.

Anthidium anguliventre F. Morawitz.

Jerusalem, 1 ♀, 6. vi. 41, 1 ♂, 13. vi. 43; Wadi Kelt, 1 ♀, 2. vi. 43 (*Bytinski-Salz*).

The male has the mesonotum laterally with a broad L-shaped pale yellow stripe, reaching axillæ, and curved on each side of middle in front and projected in the disk of mesonotum below as a parallel longitudinal stripe; axillæ entirely, and scutellum broadly, pale yellow; occiput with very pale yellow stripe. In a male from Jericho, 2. vi. 43 (*Bytinski-Salz*), the occipital stripe is narrow and slightly interrupted in the middle; mesonotum has a L-shaped pale yellow stripe on each side, but the longitudinal stripes on the disk of mesonotum are lacking; axillæ and scutellum narrowly marked with yellow.

Anthidium syraicum J. Perez.

Kiriath Anawim, 1 ♀, 1 ♂, 18. vi. 43; Jericho, 1 ♂, 9. vi. 43 (*Bytinski-Salz*).

Anthidium auritum Klug (= *rufomaculatum* Fr.).

Jericho, 1 ♂, 23. v. 40; Jerusalem-Jericho Road, 22 km., 1 ♀, 18. iv. 42; Nebi-Musa-Kallia, 3 ♀♀, 2 ♂♂, 18. iv. 43 (*Bytinski-Salz*).

Anthidium spiniventre Friese.

5 km., south of Kallia, 1 ♂, 17. iv. 40; Jerusalem-Jericho Road, 22 km., 1 ♀, 18. iv. 42 (*Bytinski-Salz*).

Anthidium punctatum Latr.,

subsp. *amanusense* (Dusmet). (♀ nov.).

Dusmet described this species on a male from Syria, Mt. Amanus, but according to his original description, *Anthidium amanusense* may be considered as a subspecies of *Anthidium punctatum*, with more yellow than the

European races. The female is not described and is separated from the related *Anthidium punctatum fulvipes* Fr., as follows:—

Female. Length 8 mm.

Black, occiput with lateral yellow stripes nearly reaching middle (in *fulvipes* with a pale spot on each side); scutellum with two large yellow marks (in *fulvipes* with small pale marks); anterior and middle femora black, reddish on apex, hind femora black, apical half reddish; tibiae reddish, with basal light yellow mark above, hind ones with black stripes on inner side; tarsi reddish, hind basitarsi black except apex (in *fulvipes* the black is reduced on femora and the yellow on apex of tibiae lacking above; tarsi entirely reddish), first tergite with broad lateral yellow stripe covering sides, except narrowly apical margin (in *fulvipes* with pale yellow lateral small mark); second tergite with broad basal yellow entire stripe attenuated in middle; tergites 3 to 5 with entire transverse basal yellow stripe, that of fifth not reaching sides; sixth tergite with a yellow mark on each side of middle of disk (in *fulvipes* tergites 3 to 5 each with four pale yellow marks, two small basal and two longer on each side of middle, fifth with a pale yellow transverse mark on each side of middle, sixth black); punctuation of mesonotum dense (in *fulvipes* sparse); punctuation of first and second tergites somewhat strong on the yellow, and very dense and somewhat fine on the black of disk (in *fulvipes* similar but extremely sparse).

Ein Geb. 1 ♀ (*allotype*), 1 ♀ (*paratype*), 23. iv. 43 (*Bytinski-Salz*).

Pronthidium undulatum holozonicum Mavrom.

Jerusalem, 1 ♂, 23. vi. 40; 1 ♂, 14. v. 42; 1 ♂, 24. ix. 42 (*Bytinski-Salz*).

Anthidium ochrognathum Alfken.

Bat Jam, 1 ♀, 4. viii. 41 (*Bytinski-Salz*).

This species was described by Alfken from SOUTH EGYPT, and I have 1 ♀ from Kafr Hakkim. In the Egyptian specimen the apical margins of abdominal tergites 1 to 4 are pale yellow. The Palestine specimen has the apical margins of tergites 1 to 4 brown and the sublateral yellow marks 2 to 4 are sufficiently smaller than same in the

Egyptian specimen, and the lateral mark of first tergite is reduced to a spot. It is probable that the Palestine *Anthidium ochrognathum* represents a northern race of this species, but more material is needed to decide this.

Anthidium 7-dentatum faciale Friese.

Ein Geb, 1 ♀, 23. iv. 43; Wadi Kelt, 1 ♂, 25. iii. 41 (*Bytinski-Salz*).

Dianthidium elongatum Friese, subsp. *judæense*, nov.

Male. Length 10 mm.

Clypeus, supraclypeal area surpassing level of insertion of antennæ, lateral face marks reaching top of eyes, mandibles except apex, all creamy-yellow; occipital entire stripe a little descending on cheeks, pale lemon-yellow. Mesonotum with a broad pale lemon-yellow stripe on each side in front; tubercles, mesopleura in front, axillæ and apical margin of scutellum broadly, all pale lemon-yellow. First tergite with lateral pale lemon-yellow stripe; second tergite with pale lemon-yellow stripe attenuated and slightly interrupted in middle; third tergite with broad pale lemon-yellow stripe slightly notched in middle above; tergites 4 to 6 pale lemon-yellow, and seventh with the exception of narrowly the base in middle, all pale lemon-yellow, apical margin of tergites narrowly black; the yellow of tergites 2 to 6 bordered by dark reddish-brown suffusion below and towards apical margins; seventh tergite broad and with entire apical margin.

Jerusalem, 25. v. 43, 1 ♂ (*type*), 1 ♂ (*paratype*).

The Palestine specimens differ from the Italian and Graecian typical race in the rich extension of the yellow colour.

Dianthidium cinctum (Klug).

Jericho, 1 ♀, 23. vii. 42 (*Bytinski-Salz*).

Similar to *Dianthidium cinctum*, of which I possess a pair from SOUTH EGYPT. In the Palestine specimen the apical margins of abdominal tergites 1 to 5 are broadly ivory-white; second tergite with the apical margin produced in middle.

Another *female*, Jericho, 2. ix. 42, is similar, but the apical margin of second tergite is subhyaline.

Dianthidium hoplostomum, sp. n.

Female. Length 6.5 mm.

Black; clypeus densely and somewhat strongly punctured, shining, broader than long, apical margin broadly impunctate and semicircularly concave and with two broad elevated lobes on each side reaching base of mandibles; mandibles with an apical long tooth and an edentate basal edge, red-brown, base with pale yellow mark, apical edge black; scape black, apex narrowly brown; flagellum black-brown, second joint brown; vertex and occiput strongly and somewhat densely punctured, moderately shining; clypeus pale yellow, apical margin broadly black, lateral lobes reddish brown; supraclypeal area on each side, an oval mark below middle ocellus, occipital stripe medianly attenuated and reaching middle of cheeks, lateral face-marks reaching top of eyes, all pale yellow; head with short and very sparse whitish hairs above, the hairs on clypeus pale yellowish white. Mesonotum densely and strongly punctured, dullish; scutellum projected, rounded at sides, apical margin very slightly emarginate in middle; area of metathorax shining, punctured, sparsely punctured in middle; a broad stripe on each side of mesonotum above, axillæ at base, apical margin of scutellum interrupted in middle, mesopleura broadly above, all pale lemon-yellow; tubercles yellow; tegulæ punctured, red-brown in middle of disk, rest pale yellow; wings very slightly clouded, marginal cell clouded above; second recurrent nervure out of second transverse cubital nervure; legs light reddish brown; anterior and middle femora light yellow beneath; anterior tibiæ pale yellow, middle and hind tibiæ pale yellow above and slightly suffused with light reddish brown on outer side; spurs pale brownish yellow; pulvilli present; hind basitarsi with dense short light golden-white hairs on inner side. Abdomen black, shining; first tergite strongly punctured, black, with slight reddish-brown suffusion, and with very broad pale yellow mark on each side; tergites 2 to 4 strongly punctured, apical margins narrowly impunctate and polished; sixth tergite rounded; second tergite with broad pale yellow lateral stripe attenuated within and nearly reaching middle (the stripe notched by reddish brown on each inner side above), apical margin and a

little above it (except the sides) dark reddish brown; third tergite with broad pale yellow stripe reaching middle, rest as preceding; fourth tergite with broad pale yellow stripe very slightly interrupted in middle and slightly notched by black in middle above, rest as preceding; fifth tergite, except the narrowly black base, pale yellow slightly notched in middle above, apical margin broadly deep reddish brown (narrowly at sides); sixth tergite pale yellow, apical margin broadly, sides and base light reddish brown; abdomen with some pale bristles on apical margin of last three tergites; those on sixth somewhat more but very short; basal sternites light reddish brown; sixth sternite reddish brown, apical margin rounded and slightly crenulated; ventral scopa white.

Male. Length 6.5 mm.

Similar to the *female*; clypeus ochreous, apical margin very narrowly polished, impunctate, light reddish brown, without lobes and broadly emarginate in middle; mandibles ochreous except the black-brown apex; lateral face-marks nearly reaching top of eyes, all supraclypeal area ochreous; occiput with pale yellow stripe on each side not reaching middle and a little descending on cheeks; scape black, with ochreous spot subapically in front, apex narrowly pale reddish brown; flagellum brown; first joint of flagellum dark, somewhat longer than second, longer than broad (seen from in front); second joint light, with apex broader than base; pilosity on head scanty above, but more than in the *female* and white. Legs with short white hairs above and on outer side; hind basitarsi pale yellow, apex very narrowly light reddish brown. First abdominal tergite pale yellow at sides (except narrowly the base), apical margin broadly pale reddish brown (except the sides); second tergite broadly pale yellow at sides, the pale yellow extended transversely within to a narrow bar-like stripe nearly reaching middle; apical margin of second tergite entirely and a little above it (except the sides) yellowish red and with pale yellow suffusion; tergites 3 to 7 pale yellow, base of third broadly and of fourth very narrowly, sides of fifth and sixth, all narrowly black; apical margins of tergites 3 to 6 reddish-yellow (very broadly on third, broadly on fourth); sixth tergite broad, apical margin entire and rounded;

seventh tergite short, with nearly parallel sides, apical margin rounded on each side, slightly emarginate and with a minute tubercle in middle, base of disk medianly produced into a broad large tubercle pointed at the apex (seen from above), sternites reddish brown, with short whitish hairs; apical margin of sixth sternite entire, that of seventh rounded.

Jerusalem, 1 ♀ (*type*), 1 ♂ (*allotype*), 20. vi. 38 (*J. Glimcher*), in my collection.

This interesting species is related to *Anthidium clypeare* F. Mor., from DAGHESTAN. Derbent, but is very distinct. Morawitz in his description of *Anthidium clypeare* says that "the area of metathorax is densely punctured and nearly everywhere dull, clypeus apex with two dentiform tubercles. Lepeletier described *Anthidium quadrilobum* = *laterale* and *Anthidium sinuatum* with an almost similar clypeus." This opinion of Morawitz induced me to interpret that the clypeus in his *Anthidium clypeare* has two dentiform tubercles on each side of the middle, as in *Anthidium laterale* Latr., or *Anthidium sinuatum* (= *bellicosum*). In *Dianthidium hoplostomum*, sp. n., the area of metathorax is shining, the apical margin of the somewhat short and broad clypeus is semicircularly concave, broadly polished and having a large lobe on each side reaching the mandibles; the lobes are vertically elevated within.

VIII.—On the *Melolonthine* Beetles of the Genus *Hemisericia*, including a few new Species. By GILBERT J. ARROW, F.Z.S., F.R.E.S., British Museum (Natural History).

THE aspect of the curious genus *Hemisericia*, belonging to the Sericini and chiefly remarkable for the narrow snout-like fore-part of the head, is rather like that of the Ruteline genus *Anisoplia* and suggests the probability of some degree of similarity in the feeding-habits. Species of *Anisoplia* are liable to occur in immense numbers in Eastern Europe, and *A. austriaca* is reported as responsible for very serious depredations in Hungary and South Russia by devouring the ears of wheat. Probably their larvæ are equally injurious to the roots.

Nothing has been recorded as to the habits of *Hemisericia*. More than half a century has passed since Brenske,

in 1894 (Mem. Soc. Ent. Belg. ii. p. 57), described the genus, with its Indian species *Hemiserica nasuta*, and it seems to have since remained unknown. Re-describing it in 1897 (Berl. Ent. Zeitsch. r. vol. xlii. p. 385), Brenske attributed the locality Saidabad, in which it was found, to Kashmir and added that two specimens in the Oberthur collection represented another species. The reputed habitat of these, Bombay, he considered doubtful, probably because he regarded the genus as a Palaearctic one. In the British Museum collection are specimens of the genus collected in 1904 at Hungund, Bagalkot, in the Bombay Presidency, and Brenske's doubts are therefore unfounded. On the other hand, I have found no place named Saidabad in Kashmir. The Indian Post-Office Directory contains three places so named, one near Patna, one near Allahabad, and the third near Hyderabad (Sind) in the Bombay Presidency. It seems not altogether improbable that the last is the real place of origin of *Hemiserica nasuta*. The unnamed form in the Oberthur collection is said to have a more broadly-lobed clypeus, and that from Hungund in the British Museum does not appear to correspond with either of the species known to Brenske, but the specimens are females and in bad condition. Two other specimens, from Southern India, were taken by M. Walhouse in the Nilgiri Hills district and have been in the Museum collection for more than eighty years. They appear to resemble rather closely Brenske's second species. Another closely-related form, in the Museum since 1884, bears the rather vague locality N.W. India, and yet another, less closely related but agreeing in its essential structure with the typical species, was also found in the Nilgiri Hills district. It seems likely that *Hemiserica* will prove to be a purely Oriental genus.

The two sexes of the genus differ little, but may be distinguished by the larger eyes and longer antennal club of the male.

Brenske includes in his diagnosis of the genus an antennal club of three lamellæ in both sexes. In the male of *H. armipes* there are five lamellæ, but the variable number of the lamellæ in Melolonthine genera is a notable peculiarity of the group. In a recent paper (Ann. & Mag. Nat. Hist. (11) xi. 1944, pp. 633-634) I have mentioned several instances amongst the true Melolonthini, and

Brenske has himself noted cases occurring in the *Sericini*, e. g., *Neoserica* and *Microserica*. Moser has noted the same in *Pachyserica*.

Hemiserica bilobata, sp. n.

Bright yellow, with the head, pronotum, scutellum and legs pale reddish yellow, the whole surface, except that of the head and legs, covered with an opaque pruinose bloom and the elytra slightly iridescent; oval and convex, the head shining, rugosely punctured in front, where it divides into two blunt, strongly-reflexed lobes, separated by a rounded excision and a short, sharp longitudinal carina, the forehead finely and sparsely punctured, the pronotum strongly punctured, its sides well rounded, the front angles acute and the hind angles very blunt, the elytra with rather ill-defined grooves, containing numerous crowded punctures. Pygidium and lower surface opaque, the former sparingly punctured, the hind coxæ strongly and closely punctured.

♂. Eyes large, the intervening space equal to their combined widths as seen from above, joints 3 to 7 of the antenna short and nearly equal, 8 to 10 forming a club longer than the footstalk.

Length 7 mm.

SOUTH INDIA: Nilgiri Hills (*M. Walhouse*).

The two male specimens were probably taken at Coimbatore. The rather strongly bilobed clypeus is of quite a different form from that shown in Brenske's figure of the head of *H. nasuta* in Berl. Ent. Zeitschr. 1902, pl. i. fig. 1, but appears to resemble that of his unnamed second species. *H. bilobata* is a little larger than *H. nasuta* and *H. pallida*, which follows here, and rather darker in colour than the latter, with the sculpture of the upper surface a little stronger.

Hemiserica pallida, sp. n.

Bright yellow, with the elytra paler and the head and tarsi reddish, the whole surface, except that of the head and legs, covered with an opaque bloom and the elytra slightly iridescent; oval and convex, the head very shining, not closely or deeply punctured, almost smooth in front, with the extremity very feebly dilated and scarcely emarginate in the middle, the forehead also rather sparingly punctured, the pronotum evenly and

distinctly but not closely punctured, with the front angles acute and the hind angles distinct but slightly obtuse, the elytra bearing fairly well-defined grooves, containing numerous rather strong and sometimes crowded punctures, the sutural angle rather sharp. Pygidium and lower surface opaque, the former sparingly punctured, the hind coxæ strongly and moderately closely punctured.

♂. Eyes large, the intervening space as wide as their combined widths as seen from above, joints 3 to 7 of the antenna short and nearly equal and 8 to 10 forming a club a little longer than the footstalk.

Length 6 mm.

N.W. INDIA (*C. Horne*).

Three males and two females. The clypeus has not the shape shown in Brenske's figure, it is scarcely perceptibly excised in front and is not closely punctured, as described for *H. nasuta*. The antennal club of the male, said to be as long as the footstalk in *H. nasuta*, is very distinctly longer in *H. pallida*.

Hemiserica armipes, sp. n.

Ferrugineous yellow, with the head and tarsi slightly more reddish, the surface with a slight bloom except upon the head and legs; oblong-ovate, convex, with the head triangular, shining, deeply and rather strongly punctured, the sides strongly convergent and the extremity reflexed, not dilated, blunt, the pronotum rather strongly and closely punctured, with the front angles acute and the hind angles distinct but obtuse, the elytra roughly punctured, with ill-defined longitudinal grooves, the sutural angles distinct, the pygidium finely punctured. Hind leg with the coxa strongly and closely punctured and its inner margin produced backwards as a short but sharp spine, the femur and tibia short and broad.

♂. Eyes large, the intervening space less than their combined widths as seen from above, antennæ with joints 3 to 5 long and closely connected, 5 to 10 forming a club much longer than the footstalk.

Length 5 mm.

S. INDIA: Podanur, Coimbatore (*A. K. Weld-Downing*).

A single male specimen.

This is smaller than the other species but resembles them in most of its features, differing conspicuously, however, in the number of lamellæ composing the club

of the antenna. In his tabulation of the genera of Sericini, in which he employs chiefly the number of these lamellæ, Brenske has placed *Hemiserica* in his largest category, with three lamellæ in both sexes. *H. armipes*, having five lamellæ in the male, would have been referred by him to a different group of genera; but, since his scheme leaves nearly all females undeterminable and he has found himself obliged to include in three of his four categories genera referable also to one of the others, his method is obviously a very unsatisfactory one and allows undue importance to the structure of the male antennæ. Although it may ultimately be found desirable to make a new genus for the present species, I consider it better to refrain from doing so until we are able, by examination of the other sex, to determine which of its features are peculiar to the male.

Except in its antennæ, *H. armipes* differs little from the allied species. It is a little smaller and the upper surface is more closely, but not more finely, punctured. The head is triangular, its sides converging almost to the tip of the clypeus, which is very narrow and reflexed, but not at all lobed or notched. A distinctive feature not found in the related species is the production of the contiguous inner edges of the hind coxæ to form sharp spiniform processes. This may be peculiar to the male.

IX.—*Some Notes on the Development and Classification of Parasitic Copepoda.* By ROBERT GURNEY.

I. THE DEVELOPMENT OF THE LERNÆOPODIDÆ.

It is remarkable that, in spite of the close attention that has been paid to every detail in the biology of the salmon, practically nothing was known of the life-history of the maggot (*Salmincola salmonea*) which is so common on its gills until the publication, in 1941, by Friend* of a full account of every stage in its development. So little is known of the development of the family Lernæopodidæ that Friend's work is of great value, but it is unfortunate that he seems to have been unaware of the previous publication† of a description of the development of *Clavella uncinata*, another member of the family. His

* Trans. Roy. Soc. Edinb. lx, pp. 503-541.

† Gurney, Proc. Zool. Soc. 1934, pp. 177-216.

work would have had added value if he had made a comparison between the two and explained the great differences between them. There are three points which I think worth discussion.

A. *The Copepodid Stages.*

Whereas *C. uncinata* hatches as a nauplius, *S. salmonea* hatches as a copepodid, and this first copepodid attaches itself to the gill by a frontal filament just as *Clavella* does; but there ensues a first moult which produces a second copepodid with reduced appendages, and still attached by the filament, which is now free from the head and grasped by the maxillæ. In *Clavella* it is not quite certain if there is a moult, but the exact equivalent of Friend's second copepodid has not been seen. The first stage known to succeed the first copepodid is a degraded creature in which the adult structure is discernible, attached by frontal filament and maxillæ, as in *Salmincola*, and enveloped in the remains of the copepodid cuticle. Friend, having found a second copepodid stage intermediate between the free copepodid and the degraded adolescent, objects to my definition of the *Lernæopodidæ* as a group of *Copepoda*, which do not develop beyond the first copepodid stage. It seems to me that Friend's work only confirms this definition.

Throughout the *Copepoda* the first copepodid invariably has two pairs of swimming legs only, and the second stage has three. So far as is known, no *Lernæopod* has at any time in its development more than two pairs of swimming-legs, and *Salmincola salmonea* is no exception to this rule. After the first copepodid no new limbs are acquired, but those already present degenerate and eventually disappear. If there is a moult without change of form I do not think it affects the main point, which is that the *Lernæopodidæ* owe their peculiar adult form to their becoming mature at an early larval stage and being free to develop along lines outside the bounds of the normal *Copepod* form.

B. *The Origin of the Bulla.*

In *Clavella* the origin of the bulla, or disc of attachment, by which the maxillæ are fastened to the gill, is not certain. No stage intermediate between the first

adolescent attached by frontal filament and the second attached by the bulla was found, but it was suggested that this stage was, perhaps for a few moments only, free, and that, during this time, it moved from the apex nearer to the base of the gill-filament and developed the bulla. It was quite clear that the latter had nothing to do with the frontal filament, and it was suggested that it was a product of the maxillæ themselves. Friend found that there is a free stage in *Salmincola*, during which the animal is attached by claws on the maxillipedes, and this stage lasts long enough for considerable growth to take place and for fertilisation to be effected. During this stage the bulla is formed inside the head region, from which it is extruded (presumably by bursting of the cuticle) and is attached to a gill-filament. The two maxillæ then fix themselves to the base of the bulla, so effecting the final fixation. Friend gives figures of all stages of this very remarkable development, which is an original discovery of great interest. Is it possible that the bulla is in all cases formed in this way? I find it difficult to believe that it is so in *Clavella*, since the bulla formed in the head of *Salmincola* seems to be very conspicuous, and nothing of the kind was noticed in *Clavella*. Also the position of the maxillary arms in relation to the head would make it much more difficult for them to connect with a bulla extruded from the head than it is in *Salmincola*.

If the bulla in *Clavella* is, in fact, a product of the maxillæ, it is not homologous with that of *Salmincola*, and this would be an important systematic difference. It is most desirable that the early stages of other species of Lerneopodidæ should be investigated to settle this point.

C. Number of Moults.

There is considerable difference between *Salmincola* and *Clavella* in the number of moults of the copepodid. In the latter only one moult was definitely established, namely, that of the first copepodid; but it was presumed that there might be a second before the copepodid form was finally lost. The attachment by filament was not broken at this moult because the animal remained enclosed in the copepodid skin. In *Salmincola* a second moult produced an adolescent attached by the maxilli-

pedes, and a third the adult form attached by the bulla. After that there were no more moults. Here, again, there is a considerable difference, with a further simplification or condensation of development in the less primitive *Clavella*.

It is to be expected that the development of the gill maggot of the trout, *S. gordonii*, will be identical with that of *S. salmoneus*, but it should be easier to follow, inasmuch as its whole life is passed in fresh water. It is to be hoped that it, and also the parasite of the grayling, *Salmincola thymalli*, may have their life-history worked out in detail, with special reference to the points here raised.

II. THE CLASSIFICATION OF THE PARASITIC COPEPODA.

The great variety of form with hypertrophy of some parts and degeneration of others has made a rational grouping of the parasitic Copepoda peculiarly difficult, but the acquisition of some knowledge of their development has made it possible to decide with certainty on some relationships. For instance, there is no doubt that the Caligidae are so closely akin to the Lernæoceridae, however different the adults may be, that they must be included in one group, and Wilson divided the non-Cyclopoid genera into two groups, Caligoida and Lernæopodoida. If we can concede that the Lernæopods owe their peculiar form to pædomorphosis and that the first cyclopoid stage is essentially the same as that of the Caligidae, then it would be necessary and desirable to recognise only a single large group, for which the name Caligoida may be retained, with sub-groups Lernæiformes, Caligiformes, Achtheriformes and Nicothoëformes. This is the system which I have myself adopted*, but I have a letter from the late Dr. C. B. Wilson in which he strongly objects to this union of the Lernæopods within the same group as the Caligidae. He emphasised the profound difference between the adults of the two groups, and maintained that there was but little agreement in the ontogeny. He claimed that, although there is a frontal filament in both, "it is very different both in structure and mode of operation," and that some genera of Caligidae do not have it.

* 'British Freshwater Copepoda,' vol. viii. 1938, Ray Society.

I do not find it possible to believe that the frontal filament has been separately evolved in these two groups, and I see no difference whatever in structure or use in the first copepodid. In the *Lernæopods* it functions for a very short time and is thrown off with the copepodid skin when the maxillæ take over the business of attachment to the host. It appears from Wilson's writings that he believed the bulla to be developed from the filament, and if that were so it would be justifiable to say that it is very different in structure and function in *Caligus* and *Salmincola* for example. But it is now perfectly clear that the bulla is a new organ having nothing to do with the filament. That some *Caligidæ* do not have the filament does not seem to affect the question. It is also absent in *Lernæa* and present in *Lernæocera*, but Wilson included both genera in one family none the less. In point of fact, on this and other grounds I consider these two genera should be typical of two distinct families.

There are other genera of fish parasites among the *Chondracanthidæ*, *Dichelesthidæ* and *Sphyrnidæ* which have, either in female or male or both, fewer than the normal four pairs of swimming legs, and it would be of interest to know if they, like *Lernæopods*, have become mature precociously.

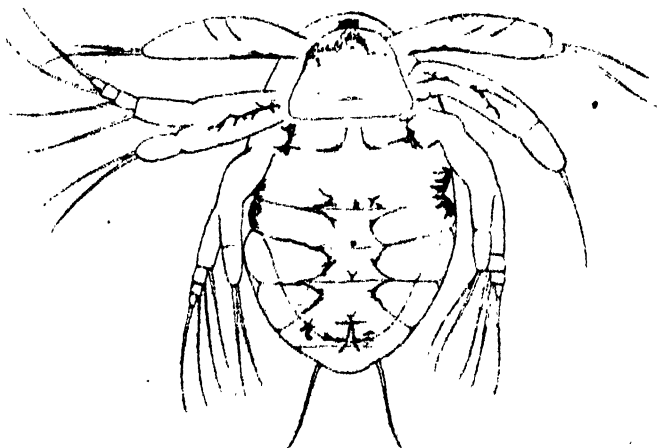
The dwarf males of the *Chondracanthidæ* are remarkably like those of the *Lernæopods*, but the resemblance is probably convergent, as the mouth parts indicate relationship to the *Ergasilidæ*. The development beyond the nauplius is quite unknown.

The *Dichelesthidæ* are a family of which the ontogeny is not known beyond the nauplius. The adults range from the genus *Nemesis* in which the cyclopoid form is almost unmodified, with five pairs of legs and fully segmented thorax and abdomen, to genera like *Lernanthropsus* in which all segmentation of the body may be lost, but with four pairs of legs of which the last two pairs are modified into large respiratory (?) appendages. In some genera the legs are very much reduced, and only one pair is present in *Norion* and two in *Cæstrodes* and *Hatschekia*.

In *Hatschekia labracis* there are traces of legs 3 and 4, or at least an indication of the existence of thoracic somites belonging to them. It would seem that those genera of *Dichelesthidæ* with reduced number of appen-

dages do not owe this reduction to their coming to maturity at the first or second copepodid stage as in Lernæopods. It seems fairly certain that they pass through a normal series of copepodid stages, but that the segmentation of the thorax and the posterior appendages degenerate, or are not fully acquired. I have tried to work out the development of *H. labracis* without success. The nauplius (fig. 1) is of simple type without mouth and with biramous

Fig. 1.



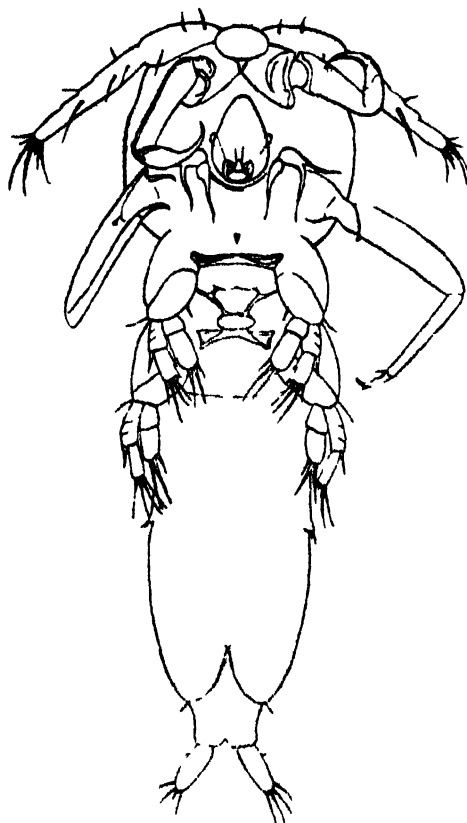
Nauplius, 0.18 mm. Colour greenish yellow with brown markings.

antenna and mandible. Behind the mandible are traces of four pairs of appendages under the skin. The anal setæ are not flattened as in Caligidæ. I have not been able to obtain any copepodid stage by moult or from the gills of the host. The earliest stage found on the gill is about 0.5 mm. long (the adult female is about 1.7 mm.) and has already the adult structure (fig. 2). It seems possible that the intermediate copepodid stages may be passed on some other host.

In the Sphyrriidæ there are in some genera traces of four pairs of legs, so that, although we know only the first copepodid of *Pæon*, it seems probable that the reduction of appendages when it occurs is secondary and not due to arrest of development.

It is clear that a final agreement on the classification of the parasitic Copepods awaits further research into the ontogeny, and existing systems depend too much upon speculation. But there does seem to be good reason to suppose that the phylogeny is best expressed by uniting

Fig. 2



Young male from gill of *Labrus bergylla*, 0.5 mm.
In dorsal view the somite of leg 4 is indicated by a groove.

all the fish parasites except the Chondracanthidæ in one large group, and that within this group the Lernæopodidæ should be included, although they alone seem to have their development arrested at the stage of cyclopoid 1, or possible cyclopoid 2.

X.—Preliminary Catalogue of African Pipunculidæ.

By W. F. RAPP, Jr., and J. L. COOPER.

A CAREFUL study of the literature dealing with African Diptera revealed that no catalogue or check-list of the Pipunculidæ of Africa exists. In 1910, Kertész* published volume iv. of his Diptera catalogue, in which he listed the Pipunculidæ. As a rule, Kertész did not give country names, but merely the section of the continent where the species had been reported. The limited amount of literature dealing with African Pipunculidæ is difficult to locate and deals largely with the description of new species. The authors hope that sometime in the future they will be able to present a more complete catalogue. However, this catalogue is offered so that entomologists who have occasion to determine African Pipunculidæ will have some idea of the African species.

At present all species are in the genus *Pipunculus*, but a careful study of the species will probably cause some of them to be placed in other genera.

PIPUNCULUS Latreille.

abdominalis Loew, Ofvers. af K. Vet. Akad. Forhandl. 1857, p. 374.

Southern Rhodesia, Union of South Africa (Caffrerei).

aculeatus Loew, Ofvers. af K. Vet. Akad. Forhandl. 1857, p. 375.

Union of South Africa (Caffrerei).

bequaerti Curran, Amer. Mus. Nov. 340 (1929), p. 1.

Belgian Congo.

brevicornis Loew, Ofvers. af K. Vet. Akad. Forhandl. 1857, p. 374.

Union of South Africa (Caffrerei).

claripennis Loew, Ofvers. af K. Vet. Akad. Forhandl. 1857, p. 375.

Union of South Africa (Caffrerei).

cupreiventris Becker, Ann. Soc. ent. France, vol. lxxxiii. (1914) p. 126.

Uganda.

disjunctus Becker, Berlin Ent. Zeit. vol. xlii. (1897) p. 239. Egypt.

fluvialis Becker, Berlin Ent. Zeit. vol. xlv. (1900) p. 224. Egypt.

* Kertész, K., 'Catalogus Dipteriorum,' vol. iv.

- glabrum* Adams, Kans. Univ. Sci. Bul. vol. iii. (1905) p.165.
Southern Rhodesia.
- katonæ* Kertész, Annals Musei Nationalis Hungarici,
vol. v. (1907) p. 581.
Tanganyika (German East Africa).
- liberia* Curran, Amer. Mus. Nov. 340 (1929), p. 2.
Liberia.
- lubuti* Curran, Amer. Mus. Nov. 340 (1929), p. 1.
Belgian Congo.
- mutatus* Becker, Berlin Ent. Zeit. vol. xlii. (1897) p. 85.
Egypt.
- nitidifrons* Becker, Berlin Ent. Zeit. vol. xlv. (1900) p. 241.
Egypt.
- pallidipleura* Curran, Amer. Mus. Nov. 340 (1929), p. 2.
Belgian Congo.
- parvifrons* Loew, Ofvers. af K. Vet. Akad. Forhandl.
1857, p. 371.
Union of South Africa.
- pilosiventris* Becker, Berlin Ent. Zeit. vol. xlv. (1900)p.236.
Egypt.
- trochanteratus* Becker, Berlin Ent. Zeit. vol. xlv. (1900)
p. 221.
Egypt.
- umbrinus* Loew, Ofvers. af K. Vet Akad. Forhandl. 1857,
p. 374.
Union of South Africa.
- vicinus* Becker, Berlin Ent. Zeit. vol. xlv. (1900) p. 238.
Egypt.

XI.—*New Species of Blepharida from Africa* (Halticinae,
Col.). By G. E. BRYANT, Imperial Institute of Entomology.

THE African section of the genus *Blepharida* will, I think, in time prove to be a large one. Weise, in Sjöstedt's Kilimandjaro Meru Expedition, 1909, p. 220, divides the genus into three on the character of the claws.

Blepharida Rogers—the claws cleft.

Blepharidella Weise—the claws appendiculate.

Eutheca Baly—the claws simple.

He there states that *Blepharidella* contains seven species, without mentioning which they are. The genus

Blepharida contains 23 species, to which I now add nine new species. *Eutheca* contains two species. In many species the dark markings forming patterns on the elytra are very irregular, causing the pattern on the elytra to be asymmetrical. Jacoby, in Trans. Ent. Soc. Lond. 1895, p. 324, is quite wrong in sinking his own species, *B. holubi* Jac., to *B. reticulata* Baly. The size and sculpture are different, and the claw character of *holubi*, being appendiculate, places it in *Blepharidella*. All the types of the new species are in the British Museum Collection.

Blepharida occidentalis, sp. n. (Fig. 1.)

Head and prothorax flavous, the elytra paler, with an irregular black pattern, punctate-striate, the punctures not close together.

Length 7 mm.

♂♀. Head flavous, rugosely punctured near the eyes, the basal portion smooth, a longitudinal impression near the insertion of the antennæ, the mandibles tipped with black. Antennæ flavous, extending slightly beyond the base of the prothorax, the first and third segments the longest. Prothorax flavous, transverse, the sides from the base to the middle straight and thence contracted in front, finely but not closely punctured, a median rounded impression near the basal margin, and an impression in the middle of the side margins, a short impressed punctured line near the anterior angles. Scutellum flavous, nitid. Elytra with the sides parallel, rounded at the shoulders, and tapering to the apex, pale flavous, paler than the prothorax, with an irregular black pattern, punctate-striate, the punctures not close together, the intervals between the third and fourth and ninth and tenth striae with fewer black markings. Legs fulvous, the ♂ with the first segment of the anterior tarsi dilated, the posterior femora strongly dilated and punctured. Under-side fulvous, the ventral segments of the abdomen clothed with fine golden pubescence, the ♂ with the apical segment notched.

CAMEROONS: Buar, 10-29. v. 1914, 7 specimens.

Allied to *B. pitmani* Bry., but smaller, not so broad and convex, and the elytra showing more of a striped pattern.

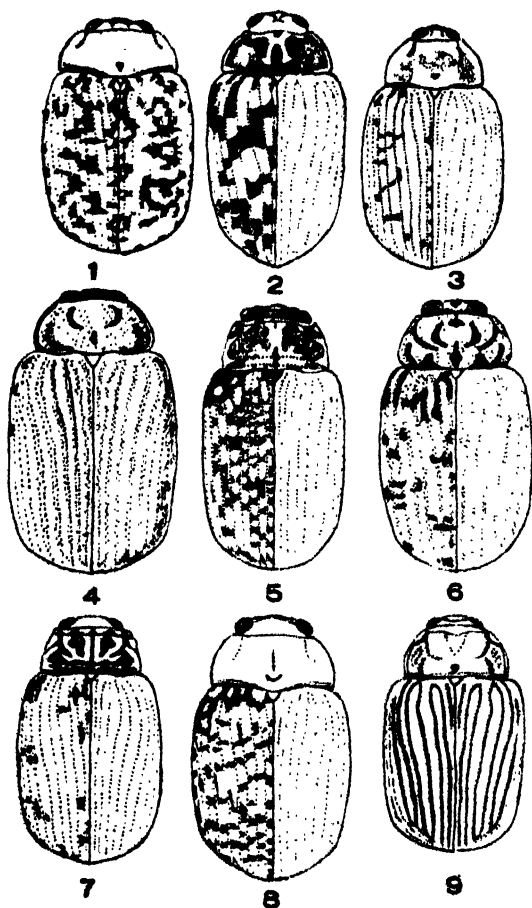
Blepharida guttula, sp. n. (Fig. 2.)

Ovate, below deep fulvous, above the head fulvous, prothorax fulvous, margined with flavous, elytra flavous,

with many irregular deep fulvous spots and patches, strongly punctate-striate.

Length 7.5 mm.

Figs. 1-9.



1. *Blepharida occidentalis*, sp. n.
2. *Blepharida guttula*, sp. n.
3. *Blepharida upmunda*, sp. n.
4. *Blepharida sulanica*, sp. n.
5. *Blepharida burtti*, sp. n.

6. *Blepharida geminata*, sp. n.
7. *Blepharida delineata*, sp. n.
8. *Blepharida pitmani*, sp. n.
9. *Blepharida carinata*, sp. n.

Head fulvous, the clypeus and palpi flavous, a few scattered punctures near the eyes, clothed with short scattered golden pubescence, a longitudinal impression

near the inner margin of the eyes. Antennæ fulvous, extending just beyond the base of the prothorax, the four basal segments more slender. Prothorax transverse, the sides contracted in front, the sides margined, and a strong median fovea near the side-margin, the sides margined with flavous, the vertex with a fulvous pattern enclosing a median X-shaped flavous marking. Scutellum triangular, fulvous, impunctate. Elytra slightly broader than the base of the prothorax, rounded at the apex, flavous, with irregular deep fulvous spots and patches, connecting the strongly punctate striæ, the pattern on the elytra is very asymmetrical, the punctures of the striæ are deep and fulvous. Legs fulvous, the claws cleft, the posterior femora strongly incrassate and closely punctured. Underside fulvous, the ventral segments of the abdomen closely and shallowly punctured.

TANGANYIKA TERRITORY: Morogoro, 15. i. 1925 (*A. H. Ritchie*), 3 specimens.

Allied to *B. marmorata* Baly (*Podontia*), but differs in being larger, more elongate and less convex, and the pattern on the elytra not so compact.

Blepharida ugandæ, sp. n. (Fig. 3.)

Below fulvous, above flavous, the prothorax with a faint fulvous pattern, the elytra flavous, closely punctate-striate, the punctures and striæ deep fulvous, the striæ connected by irregular short transverse fulvous lines.

Length 7 mm.

♂♀. Head flavous, rugose, closely punctured near the eyes, clothed with short scattered golden pubescence, longitudinally impressed near the inner margin of the eyes, the mandibles with the apical portion black. Antennæ extending slightly beyond the base of the prothorax, the four basal segments paler, more elongate and slender than the seven terminal segments, which are darker and shorter. Prothorax very transverse, the sides contracted in front, strongly margined, with a median fovea, flavous, with an obscure fulvous pattern, an oblique row of deep fulvous punctures near the anterior angles, at each side extending half the length of the prothorax. Scutellum fulvous, triangular, impunctate. Elytra flavous, with ten rows of strongly punctured striæ, the punctures deep fulvous, and joined with fulvous, at the base two fulvous spots and a curved fulvous marking near the shoulder, the striæ connected by short transverse

fulvous lines forming a very irregular pattern. Legs fulvous, the first segment of the anterior tarsi in the ♂ more dilated, the claws cleft, the posterior femora strongly dilated. Underside fulvous, the ventral segments of the abdomen clothed with short golden pubescence.

UGANDA: Kampala, 6. iv. 1930 (*G. L. R. Hancock*); 3 specimens (*Holotype*); Entebbe, 10. iii. 1915 (*C. C. Gowdey*), No. 4007, 1 specimen; Mubende, 10. i. 1933 (*H. Hargreaves*), 1 specimen; Bwera, 5. v. 1913 (*C. C. Gowdey*), No. 3611, 1 specimen; Mbarara, 29. v. 1911 (*C. C. Gowdey*), No. 2584, 1 specimen; Madi, v. 1927 (*G. D. Hale Carpenter*), 7 specimens; Northern Buddu, 3,800 ft., 16-18. ix. 1911 (*Dr. S. A. Neave*), 3 specimens.

Allied to *B. crunida* Baly (*Podontia*), but differs in the elytral pattern, and the punctures of the striae are not so close and are deeper and darker.

Blepharida sudanica, sp. n. (Fig. 4.)

Flavous, the head impunctate, prothorax with semi-circular lines of strong punctures, the side-margins with a strong row of punctures, elytra with double rows of strong irregular dark punctures.

Length 9-10 mm.

♂♀. Head flavous, slightly rugose, the mandibles black, the antennae flavous, extending well beyond the base of the elytra, the first segment long, with the apex dilated, and equal to the second and third together, the second segment the shortest, the fourth longer than the third and more slender than the fifth. Prothorax transverse, flavous, with large darker punctures forming an irregular pattern of semicircular lines of punctures, the side strongly margined, and with a row of deep punctures parallel with the sides. Scutellum flavous, triangular, impunctate. Elytra with the sides more or less parallel, rounded at the shoulders and apex, flavous, with irregular double lines of dark punctures, with a few dark patches along the side-margins, and a few small dark patches near the suture and on the apical half. Legs entirely flavous, the claws cleft. Underside flavous, the ventral segments of the abdomen with fine golden pubescence, the apical segment in the ♂ strongly notched.

SUDAN: Delami, Nuba Mt. Province, 30. vi. 1929 and 20. vii. 1927 (*W. Ruedge*), 2 specimens.

This is a very distinct species on account of the double rows of punctures on the elytra. Only one other species

so far known from Kenya, which I now describe as *B. geminata*, sp. n., has this character.

Belpharida burtti, sp. n. (Fig. 5.)

Below fulvous, above the head fulvous, rugosely punctured, prothorax flavous, with a complicated fulvous pattern, elytra flavous, with an irregular fulvous pattern, strongly but not closely punctate-striate.

Length 7.5 mm.

Head fulvous, the clypeus flavous, the mandibles with their apex black, a large median fovea between the eyes, the head rugosely punctured, the punctures closer at the base. Antennæ flavous, extending slightly beyond the base of the prothorax. Prothorax transverse, the sides slightly contracted in front, strongly margined, the anterior angles prominent, flavous, with a complicated fulvous pattern, a transverse fulvous impressed and punctured line along the anterior margin, a double impressed punctured and fulvous line along the basal margin, the fulvous portion of the pattern with some strong punctures, the flavous portion almost impunctate. Scutellum triangular, fulvous, impunctate. Elytra wider than the base of the prothorax, the sides parallel and rounded at the apex, flavous, with irregular fulvous markings, strongly punctate-striate, the punctures not very close together. Legs fulvous, the claws cleft. Underside fulvous, the ventral segments of the abdomen closely but not deeply punctured.

TANGANYIKA TERRITORY: Mahughaa, 30 miles E. of Singida, xii. 1935 (*E. Burtt*), 3 specimens.

Allied to *B. guttula* Bry., but differs in the pattern of the prothorax and the transverse punctured lines along the anterior and basal margin, and in the fulvous portion being strongly punctured.

Belpharida geminata, sp. n. (Fig. 6.)

Flavous, the head with a triangular black marking between the eyes, rugosely punctured, clothed with fine scattered pubescence; antennæ with the four basal segments fulvous, the remainder black; prothorax with a well-marked black pattern strongly punctured; elytra with an irregular black pattern, punctate-striate in double rows.

Length 9 mm.

Head flavous, with a triangular black marking between the eyes, the mandibles tipped with black, rugosely

punctured, and clothed with fine scattered golden pubescence. Antennæ with the four basal segments fulvous, the remainder black, the first segment the longest, more than twice as long as the second. Prothorax transverse, the sides contracted in front, flavous, with an elaborate black pattern, a circular black marking on the vertex, with a black line connecting it to the middle of the anterior and posterior margins, an incurved black line from the anterior angles extending half the length of the prothorax, and a short curved black line near the basal angles, the black markings containing strong punctures. Scutellum fulvous, triangular, impunctate. Elytra flavous, with scattered irregular black markings, punctate-striate, with irregular double rows of punctures, the punctures not deep or close. Legs with the tibiæ black, and the apical half of the posterior femora black. Underside fulvous, the ventral segments of the abdomen closely and shallowly punctured.

KENYA COLONY: Watita Hill, Kedai, 1924 (*C. Montague Smyth*), 1 specimen.

Allied to *B. sudanica* Bry., but differs in its darker and more complicated pattern, especially on the prothorax, and the double punctate-striæ not so deep or close,

Blepharida delineata, sp. n. (Fig. 7.)

Underside fulvous, the head fulvous, prothorax flavous, with an elaborate fulvous pattern, the fulvous portion strongly punctured; elytra flavous with scattered irregular black markings, punctate-striate.

Length 7 mm.

Head fulvous, the labrum flavous, a black triangular marking behind each eye, rugosely punctured and clothed with fine scattered pubescence. Antennæ flavous, extending beyond the base of the elytra. Prothorax flavous, with a very elaborate deep fulvous pattern, a median fulvous longitudinal line connecting the anterior and posterior margins, with strong punctures, a fulvous punctured line along the anterior margin, and another along the basal margin extending up the side-margins, above this a shorter median transverse line connecting two irregular fulvous patches, a short fulvous line curving inwards from the anterior angles, and inside this an irregular triangular fulvous patch, all the fulvous markings contain strong punctures. Scutellum fulvous, triangular,

impunctate. Elytra flavous, strongly punctate-striate, the punctures dark fulvous, and a few irregular black markings connecting the striæ. Legs and underside fulvous.

TANGANYIKA TERRITORY: Lulanguru, 17 miles W. of Tabora, x.-xii. 1917 (*G. D. Hale Carpenter*), 1 specimen.

This is a very distinct species, on account of the elaborate punctured fulvous pattern on the prothorax; somewhat allied to *B. intermedia* Jac.

Blepharida pitmani, sp. n. (Fig. 8.)

Flavous, the prothorax with a vague fulvous pattern, the elytra with an irregular pattern of black net-work. prothorax with a median impression near the base, a line of punctures along the base, the elytra punctate-striate.

Length 9 mm.

Head flavous, strongly punctured near the eyes, the base with the median portion impunctate. Antennæ flavous, extending just beyond the base of the prothorax, the first segment the longest, the second slightly shorter than the third. Prothorax transverse, flavous, with a faint fulvous pattern, a median impression near the base and a row of punctures along the basal margin, a fulvous punctured impression curving outwards near the anterior angles, the side-margins contracted in front, strongly margined, with the anterior angles prominent. Scutellum fulvous, triangular, impunctate. Elytra flavous, the suture narrowly fulvous, triangular, impunctate. Elytra flavous, the suture narrowly fulvous, and a black irregular net-work connecting the strongly punctured striæ. Legs flavous, the posterior femora strongly dilated and rugosely punctured, clothed with short golden pubescence. Underside flavous, the ventral segments of the abdomen rugosely but not deeply punctured.

TANGANYIKA TERRITORY: Lulanguru (*Coryndon, Mem. Mus.*), 2 specimens; x.-xii. 1917 (*G. D. Hale Carpenter*), 1 specimen.

N. RHODESIA: Broken Hill, 3,900 ft., xi. 1931 (*Capt. C. R. S. Pitman*). 4 specimens (*Holotype*); xi. 1914 (*H. C. Dollman*), 1 specimen.

NYASALAND: Fwambo, 1895, 1 specimen.

Allied to *B. reticulata* Baly (*Podontia*), but larger, broader, and more convex, and the black markings of the elytra not nearly so close or heavy.

In the *Ann. & Mag. Nat. Hist.* 1937, p. 101, I re-named *B. reticulata* Jac. neo. Baly, from Mexico, *B. jacobyi* Bry.,

but now I find this name is pre-occupied by *B. jacobyi* Weise, 1902, so I now propose the name *B. weisci* Bry.

Blepharida carinata, sp. n. (Fig. 9.)

Entirely fulvous, with the exception of the labrum and mandibles, which are tinged with fuscous, the elytra punctate-striate, the striae black, the head, underside and legs clothed with short fine ashy pubescence.

Length 8 mm.

♂♀. Head fulvous, the labrum and mandibles tinged with fuscous, rugosely punctured, except for a smooth longitudinal median basal patch, strongly impressed between the eyes, and clothed with short fine ashy pubescence. Antennae fulvous, the six terminal segments tinged with fuscous, extending well beyond the base of the elytra. Prothorax transverse, fulvous, nitid, a strongly impressed line along the anterior and posterior margins, a short impressed line near and parallel to the side-margins, another from the anterior angles curving inwards, a V-pattern of punctures on the vertex, and strong scattered punctures in all the impressions except the basal one. Scutellum fulvous, triangular and impunctate. Elytra fulvous, deeply punctate-striate, forming black lines, the intervals longitudinally carinate. Legs fulvous, the ♂ with the first segment of the anterior tarsi strongly dilated, the tibiae and tarsi clothed with short fine ashy pubescence. Underside fulvous, clothed with fine pubescence, the ♂ with the apical ventral segment strongly notched.

ANGOLA: Received by the British Museum from the executors of Dr. Welwitsch as from the King of Portugal, 17. xi. 1875, 3,800–5,500 ft., 3 specimens.

A very distinct species on account of the black elytral striae, and in having no irregular dark patches on the elytra.

XII.—On the Type-locality of *Raphicerus campestris neumanni* (Matschie). By G. H. SWYNNERTON and R. W. HAYMAN. (From the Department of Zoology, British Museum (Nat. Hist.).)

SOME uncertainty appears to exist as to the correct type-locality of the Tanganyika Steinbok, *Raphicerus campestris neumanni* (Matschie), due to the fact that Matschie (1894) failed to specify a type in his original

diagnosis of the race. His description was based on the following two specimens collected by Herr Oscar Neumann in Central Tanganyika Territory :—(a) a juvenile male collected at "Tisso" in northern Ugogo on 25 August, 1893, and (b) a male collected at "Njangani, 35° E. 4° 50' S." in July of the same year. These localities are shown on modern maps as Itiso and Unyanganyi respectively, and are the only two quoted by Matschie. They are approximately 90 miles apart. An attempt to restrict the type-locality has brought some relevant facts to light.

Sclater and Thomas (1896-7) stated that Neumann had informed them that the localities in which he found this *Steinhok* were "Northern Ugogo, Iranga (i. e., Irangi), Usandawe, and near Mt. Gurui." There can be no doubt that Matschie's "Tisso" and Sclater and Thomas's "Northern Ugogo" refer to one and the same place, since Itiso is a village and chiefdom occupying the extreme north end of Ugogo. But what of the other collecting locality quoted by Matschie? Unyanganyi is a chiefdom situated in the Central Rift Valley of Tanganyika, west of Irangi and north-west of Sandawe. It lies about 40 miles south-west of Mount Gurui (shown on modern maps as Hanang), and could hardly be fairly said to be "near Mt. Gurui."

Roosevelt and Heller (1915) stated that the type-locality of *Raphicerus campestris neumanni* was "Mt. Gurui in Central German East Africa." Heller (*vide* Hollister, 1924), after an examination of Neumann's original specimens in the Berlin Museum, noted that the type, a male, no. A. 5591, was from "Gurui." No specimens from Gurui were mentioned in the original description. On the other hand, we have Neumann's statement quoted by Sclater and Thomas that he found the animal not at, but "near Mt. Gurui."

Allen and Loveridge (1933) gave "Ugogo" as type-locality, and stated that a specimen collected by Loveridge "near Njombe . . . should be nearly typical." If by "nearly typical" they suggested that "near Njombe" lay close to the type-locality, they were extremely inaccurate, for Njombe lies 170 miles south of the nearest point in Ugogo, and at least 270 miles from Itiso, Unyanganyi or Mt. Hanang. These authors give no evidence to support their statement that Ugogo is the correct type-locality for *neumanni*. In his Checklist, G. M. Allen (1939) only repeated the two localities quoted by Matschie,

but in a misleading form that suggested that they were both in N. Ugogo.

Further evidence on this subject is provided by Neumann himself (1900). His carefully dated itinerary and route-map combine to show that during July and August, 1893, he was never further west or north than Kwa Mtoro in Usandawe, and, in fact, neither the itinerary nor map gives any indication that he was at any time in the Unyanganyi region. He reached Gurui, about 60 miles N.N.W. of Kwa Mtoro, at the end of September, 1893. Since Heller has vouched for the actual type-specimen as being labelled "Guirui," and there is no evidence that Neumann collected at Unyanganyi, we conclude that Matschie's quotation of a specimen from the latter place in July, 1893, is unreliable, and that the type-locality should be accepted as "Near Mt. Gurui (Hanang), Mbulu District, Tanganyika Territory."

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XII.—*On the Ecdysial Fluid in Terrestrial Isopoda*. By WALTER E. COLLINGE, D.Sc.

SOME little time ago* I drew attention to the presence in *Terrestrial Isopoda* of a moulting or ecdysial fluid, which, to the best of my knowledge, had not previously been observed. Further investigation confirms the views there set forth.

* 'Nature,' 1945 (Feb. 10), p. 179.

This fluid is well known to occur in insects during the moulting or ecdysial period and is described by Wigglesworth * as follows :—“ When the epidermal cells separate from the old cuticle and begin to secrete the new, the space between the two cuticles is occupied by a thin plasma. In the later stages of moulting this space is filled by an abundant fluid, the moulting or ecdysial fluid, first clearly demonstrated by Newport. There can be little doubt that much of this fluid, which extends also throughout the tracheal system, arises by exudation from the epidermal cells ; indeed, this has sometimes been its sole source. But the epidermis of the majority of insects contains numerous glands which become active only at the time of moulting and certainly contribute to the secretion of the fluid.”

When mounting small pieces of the recently cast exuvial of *Armadillidium vulgare* (Latr.), I noticed that they adhered to the glass slide and on being removed there was a faint film on the slide where the specimens had been imposed.*

On the exuviae that had been placed in alcohol I further noticed that there was a thin glistening “ membrane ” on the inner side.

During ecdysis some of the plasma could, with care, be removed on the tip of a fine camel-hair brush and transferred to a slide. In appearance it resembled a faint streak of weak gum arabic.

Longitudinal and transverse sections of the cuticle and epiderm were made. The former of *Porcellio dilatatus* Brandt and the latter of *Armadillidium vulgare* (Latr.). These showed the old cuticle on the outside as a thin darkly-stained line, then a slight space, and below this is a uniform thin layer of non-cellular matter, which I suggest is the coagulated moulting fluid and which is secreted by flask-shaped gland-cells in the underlying epidermal cells.

As to the function of this fluid, I suggest that it is to aid the animal to rid itself as quickly as possible of the exuviae without damaging the newly formed and delicate cuticle.

* ‘ Principles of Insect Physiology,’ 1899, p. 25.

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XIV.—*Note on small Mammals from the Lebanon Mountains, Syria.* By DOROTHEA M. A. BATE, British Museum (Natural History).

PART I.

INTRODUCTION.

THE specimens with which this note deals are the imperfect skeletal remains of small mammals which were preserved in owl pellets found at the Cedars of Bsherreh, in the Lebanon Mountains, Syria, and sent home this summer (1944) by Major H. B. Cott. I am much indebted to Mr. N. B. Kinnear for giving me the opportunity of studying this little-known fauna, and also to Mr. Terzi for his drawings of the skull and teeth of *Microtus socialis*. The collection furnishes interesting local faunal information, and also the record of a species not hitherto known to occur in Syria. These results should provide an impetus for further intensive collecting, for while the larger mammalia such as bear, leopard, otter and gazelles are rapidly being reduced in numbers, or have already disappeared, there is still an opportunity of gaining a better appreciation of the small species living in this country.

Like Palestine, with which it is closely connected faunally, Syria has an extraordinary diversity of terrain contained in a small geographical area. Coupled with this are correspondingly widely contrasted ecological conditions, intensified by the great range of latitude

compared with the size of the country. The chief divisions in Syria are roughly :—the coastal belt, most of it warm, cultivated, and well watered ; centrally the great Lebanon range runs approximately north and south, rising to over 11,000 feet above the Mediterranean Sea, and, as the Ansariéh mountains, continues northwards almost uninterruptedly to join the mountains of south-east Asia Minor (Danford, 1880, p. 86), thus facilitating a faunal interchange between these two countries. Eastwards of the main Lebanon mountain mass is the Anti-Lebanon range, from which it is separated by the Coelo-Syria plateau ; still further east and north-east lies the great desert country.

In the north is diversified country, with mountains, plains, rivers and lakes, which merges eastwards into the tract of desert which embraces the upper reaches of the Euphrates, and northwards reaches to the great mountain area of Turkey in Asia. In earlier times this part of Syria in particular must have supported a rich and varied fauna which included lion, tiger, leopard, bear, and the beautiful and richly coloured Persian fallow deer (Bate, 1939), whose fossilised remains are found in immense quantities in the Pleistocene cave deposits of Palestine. To the south of Syria there is no abrupt geographical or faunal change to correspond with the present political boundary between this country and Palestine. The fauna alters gradually with changing climatic and topographical conditions, and the exact geographical and altitudinal range of many species is still unknown.

The pellets which enclosed the present collection of mammal bones are from a single locality, and are those of a single species of owl. This is the long-eared owl, *Asio otus* (Linnaeus), and it is interesting to remember that Tristram (1884, p. 91) wrote more than sixty years ago that "... there are several pairs which breed in the Cedars of Lebanon." The pellets were found at the foot of the Cedars in the famous group of these trees which crowns a hill-top above Baherreh, south-east of Tripoli, at a height of about 6,300 feet above the Mediterranean Sea. The area is under snow for several months of the year. The pellets were not separately wrapped for transit, so it is not possible to estimate their exact size or exact number. It is thought that there was a minimum

of eighty pellets, and that each usually contained a nucleus formed by a single rodent skull, in many cases with the mandible associated, and accompanied by a number of limb bones or vertebrae. Remains of two species of mammals were occasionally seen in a single pellet, but never more than this number. In a few instances bird bones only were present.

The wrapping of the pellets is formed of fur, or occasionally partially digested feathers, and it is impossible not to be impressed by the evidence of the strong pressure which the pellets must have undergone to make it possible for the fur and smaller bones to be forced into every cavity, cranny and interstice of the skull. In the vole skulls fur was forced even into the small space between the cheek teeth and the walls of the alveoli. A number of complete skulls were preserved, though often the fragile bones of the roof and base fell apart when the specimen was separated from the surrounding furry matrix. In other specimens the thin bones of the roof of the skull and the bullae were found pressed into the cranial cavity. In only one instance did I notice what appeared to be an incision on the top of the skull such as Dr. Ticehurst refers to (1939, p. 513). Cedar needles were interspersed throughout the pellets, suggesting, what is no doubt the case, that all the specimens were obtained in the immediate vicinity of the Cedar trees, and that the owls did not extend their hunting to the fertile and cultivated valleys below.

The following is a list of the mammalian species obtained, together with the number of skulls and mandibular rami identified :—

Species.	Number of specimens.
<i>Oroidura russula judaica</i>	1
<i>O. portali</i>	3
<i>Spalax</i> cf. <i>ehrenbergi</i>	1
<i>Microtus socialis</i>	59
<i>M. (Chionomys) nivalis</i>	38
<i>Apodemus sylvaticus</i>	9
<i>Cricetulus migratorius</i>	8
<i>Meriones tristrami</i> cf. <i>bodenheimeri</i> ...	2

The fauna represented is a mixed one, with a preponderance of northerly forms; this is no doubt partly due to the height of the collecting ground, over 8000 feet. As shown in the table, the greater number of specimens, nearly a hundred, are those of voles. The field mouse follows next with only nine specimens. *Microtus socialis*, a fossorial form, has not hitherto been recorded from so far south. The absence of the two species of voles, *M. guentheri* and *M. philistinus*, which were the chief species hitherto known from Palestine and Syria, is worthy of comment. It seems to confirm the suggestion put forward in the section on *M. socialis* that in these countries *M. socialis* and *M. (Chionomys) nivalis* occupy the mountain areas, while *M. guentheri* and *M. philistinus* inhabit the plains and low hills.

The mole rat, *Spalax* cf. *ehrenbergi* is the largest animal present, though the single ramus preserved has only a total length of 26 mm., a measurement exceeded by many of the vole skulls. *Crocidura r. judaica* and *C. portali* have not previously been known to occur so far north, and their presence is furthermore of interest in view of the opinion expressed by Dr. C. B. Ticehurst that in England the long-eared owl is averse to feeding on these animals, for he remarks that "... the common and pigmy shrews are frequently preyed on by the Barn-owl and rarely, if ever, by the Long-eared," and again "... the absence of shrews in the Long-eared owl's pellets was not due to lack of opportunity" (Ticehurst, 1939, pp. 515-516).

The two species of voles present in the collection, and the mole-rat are expert burrowers and are able to make provision for existence in an area which is snow-covered for several months of the year. It would, however, be interesting to know how these severe winter conditions are met by the shrews, field-mouse, small hamster and the mountain jird. It is possible that a local winter migration to a slightly lower altitude may take place.

Compared with the number of mammals, bird-remains are scarce, though those of at least four species can be distinguished. It has not yet been possible to identify these, since, owing to present conditions, specimens for comparison are not easily available.

NOTES ON THE SPECIES.

Crocidura russula judaica Thomas.

Remains of shrews are rare, and only three imperfect skulls and three rami are included in the collection. Nevertheless, two species are represented, *C. r. judaica* and *C. portali*; these differ considerably in size, the former is the larger and has actually and comparatively larger upper unicuspid teeth than those of *C. portali*, which are weak. A single skull of *C. r. judaica* is present, and it retains the complete dentition, this form is related to the typical *C. russula* of Europe (Thomas, 1919). The specimen from the Bsherreh Cedars marks an extension, both geographically and altitudinally, of the known range of *C. r. judaica*.

The recent shrews of Syria and Palestine are still imperfectly known; Dr. J. Aharoni (1930, p. 343) claims that as many as seven species occur in Palestine. Dr. Bodenheimer (1935, p. 95) seems to suggest that *C. r. judaica* and *C. portali* are two geographical races of *C. russula*, dwelling in the hills and the low ground respectively. However, as already mentioned, these two shrews differ anatomically, and, moreover, *C. r. judaica* is not restricted to the Jerusalem hills, from which it was originally described, nor to other elevated tracts of country. This is proved by Prof. T. McCown's find, near Athlit, of several dozen incomplete skulls of this species in crevices of limestone rocks in a low escarpment at the edge of the coastal plain (Bate, 1937, p. 164). Specimens of shrews collected by the Phillips Expedition at the western base of Mount Hermon were, from their coloration, referred by Dr. Glover Allen (1915, p. 3) to the typical *Crocidura russula*, but it seems more likely that they represent *C. r. judaica*.

Crocidura portali Thomas.

Crocidura portali is represented by two imperfect skulls, one of which retains the full complement of teeth, and three mandibular rami. This species is smaller, has a shorter skull, and weaker hinder upper unicuspid teeth than *C. r. judaica*; Mr. Thomas considered it to be most nearly allied, not to European species, but to the Asiatic *C. ilensis* (Thomas, 1920, p. 119). The present record

very considerably enlarges our knowledge of the distribution of this shrew, hitherto known only from the type-locality, Ramleh, south-east of Jaffa.

The definite distinction between the two species of *Crocidura* of Palestine which was claimed by Mr. Oldfield Thomas, has received corroboration in a most interesting way through the discovery of remains of two extinct species, *C. samaritana* and *C. katinka*, in the early levels of the Pleistocene deposits of the Wady el-Mughara caves near the foot of Mount Carmel. These fossil species, while quite distinct and more primitive in their osteological characters, clearly show affinity with the Recent species, *C. samaritana* with *C. r. judaica*, and *C. katinka* with *C. portali* (Bate, 1937, p. 163).

Spalax cf. *ehrenbergi* Nehring.

A single mandibular ramus of a mole rat is included in the collection; this is the largest animal present, and its size may perhaps account for its rarity in the pellets. This single ramus is insufficient for definite specific identification, but it seems most probable that it represents a form of *S. ehrenbergi*. I use Nehring's specific name, *ehrenbergi*, in spite of Sir John Ellerman's claim for priority for the name *kirgisorum*. Under the heading subgenus *Nannospalax* Palmer, this author (1940, i. p. 642) writes "All members of this group are regarded as one species by Méhely under the name *ehrenbergi*; but *kirgisorum* has page priority, and so must be used." On referring to Nehring's paper (Nehring, 1897) I find that while the description of *S. kirgisorum* (p. 178) is certainly given before that of *S. ehrenbergi* (p. 178), yet on a previous page (p. 175) there are drawings of the cheek-teeth of these two species, and here *S. ehrenbergi* is given prior place, being illustrated in fig. 2, followed by *S. kirgisorum* in fig. 4. On consulting Dr. Karl Jordan, F.R.S., he told me that according to the rules of international nomenclature since January 1, 1931, a description of a new species must necessarily be given in words to make the name valid. However, in works published before 1931, figures must be accepted as valid descriptions; therefore, in this case, the name *Spalax ehrenbergi* must stand as ante-dating that of *S. kirgisorum*.

It would be interesting to know if mole rats are numerous at the Bsherreh Cedars, and also what plants they store underground for winter food. Except for its size, this rodent might have been expected to form a larger proportion than it does of the long-eared owl's diet, since it emerges to feed above ground only at night. Interesting accounts of its habits have been given by Mr. R. I. Pocock (1917, p. 740), and also by the late Dr. Bolkay (1928). From these observations made in different regions, Palestine and the Balkans, it seems certain that mole rats generally feed above ground on grasses, superficial roots, etc. The latter author relates that since the introduction of potato planting in their habitats, subspecies of *S. monticola* have taken to feeding on potatoes, and that they also store these tubers in considerable quantity underground for winter food.

Mole rats are tolerant of very varied altitudes, some forms being known from Mediterranean sea-level (Jaffa), or below (the Caspian), while others live in upland steppe country. Bolkay (1928) records that *S. monticola monticola* is known to occur up to a height of over 6000 feet in the Vran Mountains, South Bosnia, while *S. m. hercegovinensis* is found at about the same height on the southern slopes of the Bjelašnica Mountains, Herzegovina, Yugoslavia, and is never seen below 2,700 feet.

Microtus socialis (Pallas). (Figs. 1 & 2.)

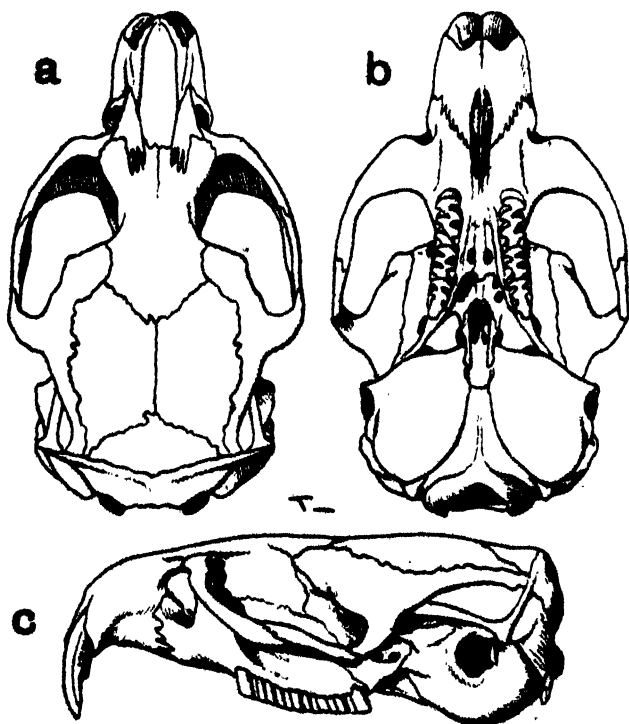
Voles are represented by a greater number of specimens than are any other of the animals included in the collection. Two species, *Microtus socialis* and *M. (Chionomys) nivalis*, have been identified, and fifty-nine specimens are referred to *M. socialis*, the largest number attributed to a single species. The proodont and shallow skull of this species, with rounded contours, and temporal ridges only feebly developed even in adult individuals, is very distinctive, and easily separates it from that of other known Syrian voles, such as the *Chionomys* and *M. guentheri* groups, in which the skull is deep and comparatively massive.

There are thirty-four skulls in varying states of preservation; the greater number are of immature individuals, and two with associated rami are practically complete

and have enabled careful comparisons to be made. One of these is shown in three aspects in fig. 1.

Regarding the pattern of the cheek-teeth it was found in each of thirty-four skulls that M^2 has a distinct postero-internal loop which only varies slightly in size. In twenty-nine out of thirty-five examples the M^3 exhibits four external and four internal salient angles, as shown in fig. 2 *b*; this is similar to the condition in

Fig. 1.



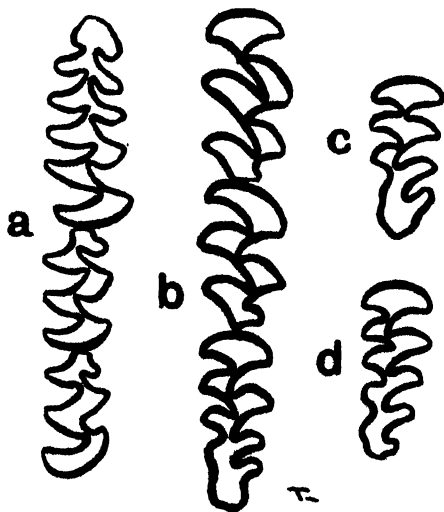
Skull of *Microtus socialis* from the Baherreh Cedars, $\times 2\frac{1}{2}$.

a. dorsal view. b. palatal view. c. side view.

the specimen from Lake Van in the British Museum Collection (97.6.4.11). Variations of this pattern are present in a small number of specimens; for instance, there are four in which the M^2 has only three external,

with the customary four internal salient angles (fig. 2 c). In two skulls of adult individuals the M^3 in one shows four external and five internal angles, while in the other there are five salient angles on either side (fig. 2 d). Other skull characters support the identification of these aberrant specimens as *M. socialis*. There is a great range in the length of the upper cheek-tooth row, which varies in thirty-four specimens from 4.8 to 6.1 mm.

Fig. 2.



Microtus socialis from the Baherreh Cedars.

- a. Right lower cheek-tooth, crown view. $\times 10$.
- b. Right upper cheek-teeth, typical pattern. $\times 10$.
- c. A right M^3 , aberrant form. $\times 10$.
- d. A right M^3 , aberrant form. $\times 10$.

The specimens in the present collection provide the first record of the occurrence of *M. socialis* in Syria, and up till now (1944) no fossil remains of this species are known from Syria or Palestine. When Dr. Neuhäuser (1936, p. 201) recognised that a skull in the British Museum (97.6.4.11) from the neighbourhood of Lake Van, Eastern Turkey, was in fact that of *M. socialis*, she considered it of special interest, saying that until then it was believed that this species did not occur in Western

Transcaucasia or in Armenia. The present discovery, therefore, presents a very considerable extension to the south and south-west of the known distribution of the species. The mountains of Northern Palestine may prove to be the southern boundary of its habitat; for in the light of this fresh knowledge it is suggested that the voles from the western base of Mount Hermon recorded by Dr. Glover Allen (1915, p. 8) as *M. guentheri* are really *M. socialis*, particularly since this author was not quite certain of the identification, and further remarked on the apparently close relationship to *M. socialis*.

It seems probable that in Syria and Palestine *M. socialis*, as well as *M. (Chionomys) nivalis*, is found exclusively in mountain regions where its fossorial habits would be highly useful, since life at heights up to, and perhaps over, 6,300 feet above Mediterranean sea-level, as at the Baherreh Cedars, would require some means of avoiding the full rigours of the climate during the winter. It may be remembered that Lake Van, from the neighbourhood of which the specimen referred to above was collected, is situated at a height of nearly 6000 feet. On the other hand, there is reason to suppose that *M. guentheri* and *M. philistinus* may be restricted to low country. Dr. B. Aharoni (1932) gives the distribution of the former as from South Palestine (Ramallah) to Armenia, and that of the latter as from the coastal area of South Palestine (Ekron) to Mersina, in Turkey in Asia.

A number of fragmentary skulls of Recent *M. guentheri* have been found in rock crevices at the edge of the narrow coastal plain near Athlit, and an extinct and primitive species belonging to this group, *M. mcCouni*, has been found in an early level of the Pleistocene deposits of the Wady el-Mughara caves (Bate, 1937, p. 194).

Microtus (Chionomys) nivalis (Martins).

Remains of snow voles are less numerous and the skulls, probably owing to their greater size, not so well preserved as those of *M. socialis*. With one exception, the nineteen skulls identified are those of young animals; the single skull of an adult with associated mandible is almost complete, and it shows the temporal ridges developed to form an indistinct flat ridge in the inter-orbital area which becomes more distinct posteriorly.

This skull is almost the same size as that of the holotype of *M. ulpius* (B.M. 3.2.2.48) from Transylvania. Among the nineteen skulls of which the cheek-teeth have been examined seventeen show the pattern of M^3 to be normal, that is to say, with only two re-entrant angles on either side. In a single example there is a shallow extra re-entrant angle on the internal side of M^3 , hardly as pronounced as that of Dr. B. Aharoni's drawing (1932, p. 212). In one other skull this tooth shows a third posterior shallow re-entrant angle on either side.

Tristram (1884, p. 13) was the first to discover a snow vole in Palestine, which he found on the higher slopes of Mount Hermon. His specimen was made the type of *M. (C.) hermonis* by Mr. Gerrit Miller (1908, p. 108), but, unfortunately, the right maxilla with the three cheek-teeth is the only portion of the skull preserved. While Mount Hermon is the most southerly known locality for a Recent species of this group, it is worth mentioning that remains of a primitive extinct species have been discovered in early levels of the Pleistocene deposits of the Wady el-Mughara caves which are situated at the edge of the coastal plain at the foot of Mount Carmel. This species, *M. (C.) machintoni* was associated with a more primitive fauna than that found in Palestine at the present day, the climate at that time is believed to have been warm and the country watered by perennial streams and clothed with a luxuriant flora (Bate, 1937, p. 196).

Dr. B. Aharoni (1932) has listed three snow voles from Syria and Palestine :—*Chionomys nivalis hermonis* Miller from Mount Hermon ; *C. n. syriacus* (Brants) from Syria ; and *C. n. pontius* Miller. This last was originally described from Asia Minor, but has since been collected at Kafrun, east of Tripoli, Syria, by Dr. J. Aharoni. The specimens in the present collection are too imperfect to admit of subspecific determination.

Mr. Chaworth Musters has pointed out to me that, since Dr. B. Aharoni (1932, p. 212) has shown that the name *syriacus* Brants, 1827, refers to what has hitherto been known as *M. nivalis* Martins, 1842, this species must take the name *syriacus*, which would thus antedate *nivalis* by 15 years. At present I refrain from making use of this revision for several reasons :—I have not had the opportunity of seeing Brants' type which he called

Hypudaeus syriacus, and the skull of which is incomplete, while, as admitted by Dr. Aharoni, the pattern of the upper cheek-teeth is not typical of *nivalis*, in fact the drawing is not unlike the pattern seen in some examples of *M. guentheri*. For her identification this author seems to have relied primarily on the characters of the skin.

Dr. Argyropulo (1933, p. 180) has grouped *M. syriacus* (Brants) with *M. socialis*, *M. irani*, *M. guentheri* and a number of other species in his subgenus *Sumeriomys*. It is hoped that it will not be long before extensive collections of the Recent small mammals of Syria are obtained, when it should be possible to determine with some certainty the identity and relationships of the voles of this area, including *M. syriacus* (Brants).

Apodemus sylvaticus (Linnaeus).

Remains of field mice are comparatively rare, and those of only nine individuals have been distinguished. These consist of fragmentary skulls, some accompanied by rami; the teeth are in various stages of wear. Such imperfect specimens cannot be assigned to a particular race, but they each represent an animal of small size, with the length of the upper cheek-tooth row ranging from 3.4 to 3.9 mm. Since the field mouse is often one of the species most commonly preyed on by the long-eared owl (Ticehurst, 1939, p. 517), its rarity in the pellets from the Bsherreh Cedars suggests that it is not common in this locality.

Dr. B. Aharoni (1932, p. 183) records only a single species of *Apodemus*, a form of *A. flavicollis*, for Syria, and lists specimens from Kafrum and Karyatin, east of Tripoli. She dismisses Tristram's record of *A. sylvaticus* (1884, p. 11) in Palestine as a mistake. However, Dr. Glover Allen (1915) recorded three species of *Apodemus* from various localities at the base of Mount Hermon; these are a small *A. sylvaticus*, *A. flavicollis* and *A. mystacinus*. He suggested that the small *A. sylvaticus* might be identical with Mr. Barrett-Hamilton's *A. s. tauricus*, described from Southern Asia Minor; unfortunately the skull of the holotype, a unique specimen, is not at present available for comparison.

It is of considerable interest that remains of several extinct species of *Apodemus*, representing early forms of the three species mentioned above, have been discovered

in the early levels of the Pleistocene deposits of the Tabun Cave near the foot of Mount Carmel (Bate, 1942).

Cricetulus migratorius (Pallas).

A hamster is represented by five imperfect skulls, two with the mandible, also three isolated rami. The cheek-teeth are in various stages of wear, from scarcely worn to so extremely abraded that the pattern is almost obliterated. The length of the upper cheek-tooth row is from 3.7 to 3.8 mm., a little less than that given for *C. m. vernula* from Asia Minor, although the skulls resemble in size those of some examples of this subspecies.

Dr. B. Aharoni (1932, p. 174) records two subspecies of *Cricetulus* for Syria and Palestine: the larger and more northerly *C. m. vernula* and the smaller and more southerly *C. m. cinerascens*. An extinct species of *Cricetulus*, *C. demetros*, has been described from one of the early levels of the Wady el-Mughara caves, which have also yielded remains of an extinct cricetine genus, *Allocricetus* Schaub (Bate, 1943).

Meriones tristrami cf. *bodenheimeri* Aharoni.

A small jird is represented by fragmentary portions of two skulls, which include the zygomatic plate, the upper cheek teeth, and also the upper incisors which are noticeably narrow and weak. The upper cheek tooth row has a length of 5 mm., slightly less than in the holotype of *M. tristrami* (B.M. 64.8.17.35) in which it is 5.5 mm.

Meriones is usually a dweller in deserts or agricultural land, so at first sight it seems surprising to find it on a high mountain top. Dr. P. Aharoni (1932, p. 200) has, however, described an interesting form, *M. t. bodenheimeri*, which is small, exceptionally dark in colour for a *Meriones*, and lives in the damp and wooded Ansarieh Mountains, which are a northward prolongation of the main Lebanon range. I have not seen an example of this form, but it is probable that the specimens in the present collection represent the same race.

PART II.

Since the above note was written a second and smaller collection has been received from Syria. This includes owl pellets and also a few discarded portions of animals too large to be swallowed. The locality from which these

specimens were obtained last summer (1944) by Captain D. Buchanan in a cave in Jebel Jaj, near Laqlouq in the Lebanon Mountains, situated at a height of 8000 feet above the Mediterranean sea. In this instance the owl is the eagle-owl, a pair of which had a nest with young at this site. Mr. N. B. Kinnear tells me that the species is very probably *Bubo bubo ruthenus* Buturlin and Zhitkow, which ranges from South-east Russia into the Caucasus and Asia Minor, Northern Syria apparently forming the southerly limit of its range.

The small number of pellets were not wrapped separately for transit, but they seemed to be similar in general size and appearance to those of the long-eared owl; the condition of the contents, however, was rather different. In the eagle-owl pellets the skulls of small mammals were generally less well preserved, and less frequently accompanied by associated rami. This is perhaps explained by the more powerful digestive juices, and by the greater pressure employed by the larger bird.

No cedar nor pine needles were included in the eagle-owl pellets.

Besides the remains of small mammals enclosed in the pellets there are a few bones of a small species of hare, from which the flesh has been stripped, also some pieces of hedgehog skin with the spines attached. A few bird-remains have not yet been identified; partially digested feathers, reddish brown in colour, formed the largest pellet, which had a maximum length of 44 mm. and a maximum thickness of 12 mm. A few fragments of beetles are also included, and Dr. M. Cameron has kindly examined these and tells me that most of them represent longicorn beetles, with one small dermestid. The latter may not have been part of the owl's food, but have burrowed into the pellet after this had been ejected. It is well known that the northern eagle-owl has a catholic diet (Witherby, 1924, p. 80), and it appears from this collection that *B. b. ruthenus* has similar tastes.

The following is a list of the eight species of mammals identified:—

<i>Erinaceus</i> cf. <i>roumanicus sacer</i> ,	<i>M. (Chionomys) nivalis</i> ,
<i>Crocidura portali</i> ,	<i>Apodemus sylvaticus</i> ,
<i>Spalax</i> cf. <i>ehrenbergi</i> ,	<i>Crictulus migratorius</i> ,
<i>Microtus socialis</i> ,	<i>Lepus</i> sp.

Erinaceus cf. roumanicus sacer Thomas.

The presence of a considerable number of isolated hedgehog spines closely enveloped in vole fur makes it appear probable that these had been swallowed, perhaps unintentionally. Other spines with some fur still attached to pieces of skin accompanied the hare remains, and no doubt became detached when the flesh of the animal was torn apart. These specimens are not in themselves sufficient for specific identification, but it seems almost certain that they must represent *E. r. sacer*, both on account of the habitat, and because the spines conform to the description of those of this subspecies in having a single subterminal dark band. Mr. Oldfield Thomas chose as holotype a specimen from Jerusalem, but at the time he wrote he also had several examples from the Lebanon for comparison: the range of this form extends from Asia Minor to central Palestine; further south its place is taken by *Hemiechinus auritus*.

Three species of *Erinaceus* have been described from Pleistocene and Mesolithic deposits of Palestine (Bate, 1937, p. 166). The remains of *E. sharonis*, the geologically oldest species, suggest a possible connection with a fossil Chinese species, *E. olgai*. *E. carmelitus* from upper Palæolithic and Mesolithic levels may, perhaps, belong to the *E. roumanicus* group, while the third and smallest species from the Mesolithic almost certainly belongs to the group which includes the Recent *Hemiechinus auritus*.

Crocidura portali Thomas.

This white-toothed shrew is represented by an associated skull and mandible with teeth, and by a second skull without the lower jaw.

Spalax cf. ehrenbergi Nehring.

The collection includes three imperfect skulls and five rami. The actual and comparatively greater number of remains contained in the pellets of the larger owl supports the suggestion made above that their size prevents *Spalax* from being a favourite food of the long-eared owl.

Microtus socialis (Pallas).

Remains of this vole are more plentiful than those of any other animal, being represented by eleven skulls

and twenty-six rami. This preponderance of specimens coincides with that found in the pellets of the long-eared owl, and suggests that this species is the dominant vole of the Lebanon heights.

Microtus (Chionomys) nivalis (Martins).

Like the pellets of the long-eared owl, those of the eagle-owl contain a smaller number of remains of the snow vole than of *M. socialis*. The present collection includes only three skulls and four rami of *M. (C.) nivalis*, seven specimens as compared with thirty-seven of *M. socialis*.

Apodemus sylvaticus (Linnæus).

A field mouse is represented by an imperfect skull with the complete dentition, two left mandibular rami, and an isolated *M₁*. Like the specimens noticed in Part I. these are small, the upper cheek-tooth row having a length of 3.6 mm.

Cricetulus migratorius (Pallas).

There is only a single mandibular ramus of this small hamster, and the length of the cheek-tooth row is 4 mm.

Lepus sp.

The collection contains a pelvis and the articulated left and right hind limbs of a small hare from which the flesh has been removed, though the fur remains on the feet. The epiphyses are attached to the shafts of the limb-bones and show the animal to have been practically adult, hence the short feet, as well as the small size of the individual bones, seems good evidence of the proportions of the race to which it belongs. The length of the hind foot is 113 mm., which, so far as size is concerned, would group this hare with those of the Mediterranean Islands in which this measurement varies, for instance in the Sardinian *L. mediterraneus* from 93 to 103 mm., and in *L. creticus* from 117 to 127 mm. On the other hand, the hind foot length of the brown hares of continental Europe, excluding the Iberian Peninsula, appears to be typically over 130 mm.

Tristram (1884) records five species of hares from Syria and Palestine, and says that *Lepus syriacus* Hemp. & Ehr., found in the Lebanon, is very little smaller

than the English hare, being about 2 inches less in total length. As shown by the measurements given above, this is much larger than the present specimen. It is possible that the range of two forms might overlap in the Lebanon area, nevertheless it is very evident that there is much yet to be learned regarding the hares of Syria and Palestine.

SUMMARY.

A study of some skeletal remains of small mammals obtained from pellets of long-eared owls, *Asio otus*, living in a well-established colony in the Bsherreh group of Cedars of Lebanon, Syria, has added new and interesting facts to our knowledge of the geographical and altitudinal distribution and range of several species. Among the eight species of mammals identified, a vole, *Microtus socialis*, represented by a considerable number of specimens, provides the first record of this species for either Syria or Palestine. It is suggested that in these two countries the mountain regions are the home of *Microtus socialis* and the snow vole, *M. (C.) nivalis*, while *M. philistinus* and *M. guentheri* inhabit the plains and hills.

A second consignment of owl pellets was received later, and brief notes, Part II., have been added on the mammals contained in them. These pellets, with some other remains, are from an eagle-owl which was nesting in a cave in the Lebanon Mountains at a height of about 6,000 feet.

Reference is made to the Pleistocene representatives of several of the species; these extinct forms have been described from cave deposits in Palestine.

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XV.—*Some Observations on the Staphylinidae of the Broun Collection of Coleoptera in the British Museum, with descriptions of new Genera and Species.* By MALCOLM CAMERON, M.B., R.N., F.R.E.S.

(Continued from vol. xi. p. 793.)

OLIGOTINI.

, *Oligota (Holobus) longula*, sp. n. (Broun in litt.).

Very near *apicata* Er. Similar in colour and antennal structure, but a good deal smaller (scarcely 1 mm.) and more strongly narrowed anteriorly and posteriorly, more shining, the ground-sculpture of the head and thorax much weaker and transverse, the puncturation very fine but more evident, the puncturation and ground-sculpture of the elytra scarcely differs in the two species, the abdomen is much more strongly narrowed, the pubescence longer and coarser,

New Zealand : Waitakorei : Hunua, Maketu. Type in British Museum.

PAROLIGOTA, gen. nov.

Differs from *Oligota* Mannerh. in facies, larger more robust build, the front of the head produced, narrowed and rounded in front, the temples strongly bordered below, oval abdomen with long and outstanding pubescence, the whole insect without ground-sculpture. Maxillary palpi as in *Oligota*. Mesosternum carinate, its process broad and truncate, meeting the metasternum, the coxæ widely separated. Anterior coxæ as long as the femora. Anterior tarsi with the first three segments short, subequal, 4th as long as the preceding together: middle with 1st segment rather long, longer than 2nd and 3rd together, 4th as long as 1st: posterior with the 1st segment rather long, a little longer than 2nd and 3rd together, 4th longer than the 1st. Abdomen with the first three visible tergites transversely impressed at base. Type *zealandica* Cam.

Paroligota zealandica, sp. n.

(*Ocalea zealandica* Broun in litt.).

Robust convex shining red, the posterior margin of the penultimate tergite broadly yellowish. Antennæ with the first two segments reddish yellow, the 3rd and 4th brownish yellow, the following black. Legs reddish yellow. Length 1.5 mm.

Head very finely, sparingly punctured. Antennæ with the first two segments stout, of equal length, 3rd as long as but narrower than the 2nd, 4th and 5th small, sub-orbicular, 6th to 9th transverse, increasing in width, the penultimate nearly twice as broad as long, the 10th as long as the 8th and 9th together. Thorax transverse (3.75 : 2.3), the sides rounded in front, straight and retracted behind, the posterior angles rounded, the puncturation as on the head. Elytra longer (3.5 : 2.3) than the thorax, broader than long (4.5 : 3.5), as finely but much more closely punctured. Abdomen a little narrowed at base and apex, the sides gently rounded, as finely but much less closely punctured than the elytra. The whole insect without ground-sculpture, the pubescence

fine yellow and rather close on the fore parts, more scanty and longer on the abdomen.

New Zealand: Invercargill, West Plains. Type in British Museum.

Paroligota speculicollis, sp. n.

(*Oligota speculicollis* Broun in litt.)

Very closely allied to *zealandica* Cam., of the same size, build, colour and antennal structure, and only differs from it in the sparing scarcely perceptible puncturation of the elytra and the entirely reddish-yellow antennæ.

New Zealand: Taieri (*Fulton*). Type in British Museum.

BOLITOCCHARINI.

Encephalus zealandicus, sp. n. (Broun in litt.).

Colour and build of *latulus* Broun, but much smaller (1.2 mm.), the antennæ shorter, the ground-sculpture weaker. Antennæ with the 4th segment slightly longer than broad, 5th as long as broad, 6th to 10th gradually more transverse. In all other respects like *latulus*.

New Zealand: Hunua.

Gyrophæna punctata Broun, Man. New Zealand Col.

I. 1880, p. 87.

Gyrophæna crassa Fauv. in litt.

Shining; head black; thorax red; elytra reddish yellow with large black marking postero-externally; abdomen reddish, the 4th and 5th visible tergites infusate. Antennæ blackish, the first two segments and the last and legs reddish yellow. Length 2.5 mm.

Build of *nitidula* Gyll. but smaller, the penultimate segments of the antennæ more transverse, punctures of head larger and deeper, those on disc of thorax closer and more numerous, the elytra as closely but not at all roughly punctured and without ground-sculpture; abdomen as in *nitidula*, but ground-sculpture weaker.

♂: 7th tergite with transverse row of six tubercles across the middle, the central pair the largest; 8th with six tubercles in a transverse row, the central pair the smallest, the posterior margin produced as a blunt triangular tooth in the middle, on each side with a slender

straight spine, the margin between feebly arcuately emarginate.

New Zealand : Woodhill : Hunua, Maketu.

Gyrophæna (s. str.) *oligotina*, sp. n. (Fauvel in litt.).

Shining ; head and thorax lighter or darker reddish brown ; elytra reddish yellow, scarcely infuscate postero-externally ; abdomen brighter yellowish red. Antennæ and legs reddish yellow. Length 1.2–1.5 mm.

Of the build of *punctata* Broun and somewhat similarly coloured but smaller, the antennæ similarly constructed, head and thorax practically impunctate, the ground-sculpture scarcely visible. elytra in ♂ finely, not very closely, asperately punctured, in the ♀ yet more sparingly more finely and simply punctured, the ground-sculpture fine but distinct ; abdomen impunctate, finely coriaceous.

♂ : 8th tergite triangularly produced in the middle with rounded apex.

New Zealand : Erua. Broun collection.

Gyrophæna nugax Broun ; is placed in, *Atheta*. s. str., in the Bernhauer and Scheerpeltz Catalogue, but it is certainly a *Gyrophæna*.

Gyrophæna atriceps Broun ; is omitted from the Catalogue, it is an *Atheta*, s. str.

Gyrophæna densicorne Broun, ? genus.

Gyrophæna versicolor Broun, ! genus.

Gyrophæna socialis Broun : is an *Ocaleu*.

Stenomastax sulcicollis, sp. n. (Broun in litt. *Thectura*).

Rather dull, head black, thorax dark brown, elytra brownish yellow infuscate postero-externally, abdomen more shining than the fore-parts, black, the 5th and 6th visible tergites reddish yellow. Antennæ blackish, the first four segments and legs reddish yellow. Length 2 mm.

In size, build and colour (except of the abdomen) much like *platygaster* Kr. but duller, the antennæ much shorter and stouter, the penultimate segments $2\frac{1}{2}$ times broader than long ; ground-sculpture of head coarser, the punctures smaller, elytra duller, more finely and more densely punctured, abdomen differently coloured, more

finely and more closely punctured. In all other respects like *platygaster*.

♂: unknown.

New Zealand: Hunua. Unique. British Museum.

Stenomastax dentata, sp. n.

Homalota dentata Broun in litt.

Fore-parts greasy lustrous, abdomen more shining, brownish red, the elytra brownish yellow: 6th tergite infuscate. Antennæ red, the first three segments and legs reddish yellow. Length 1.5 mm.

Head nearly as broad as the thorax, coriaceous, rather closely covered with small punctures. Antennæ short, the 3rd segment shorter than 2nd, 4th to 10th transverse, increasing in width, the penultimate about $2\frac{1}{2}$ times broader than long, 11th stout, as long as the 9th and 10th together. Thorax transverse (2.5:2), the sides nearly straight, retracted behind, the sculpture as on head. Elytra longer (3:2) but scarcely broader than the thorax, slightly longer than broad, finely and closely punctured. Abdomen parallel, finely and closely punctured, more sparingly on the last three segments, finely coriaceous: 8th tergite with rounded posterior margin.

New Zealand: Pirongia. Broun Collection. Unique.

Arena fultoni, sp. n.

Phytosus fultoni Broun (in litt.).

Fore-parts rather dull, yellowish red; abdomen more shining, the first two visible tergites, the posterior half of 5th and whole of 6th reddish, the rest black, antennæ and legs reddish yellow. Length 2 mm.

Very similar to *octavii* Fauv. in size and build, but more brightly coloured and less shining, punctures of head smaller, more obsolete and confused with the ground-sculpture; thorax more finely, more closely and distinctly punctured, elytra more finely, more closely and obsoletely punctured. Head round, nearly as broad as thorax, the eyes small but slightly larger than in *octavii*. Antennæ short and stout, the first two segments of equal length and thickness, the 3rd and 4th slightly transverse, 5th to 10th increasing in width, the penultimate about three times broader than long. Thorax

narrower than in *octavii*, as long as broad, the sides rounded in front, straight and rather strongly retracted behind, with fine rather close obsolete puncturation confused with the coriaceous ground-sculpture. Elytra as broad as and scarcely shorter than the thorax, as long as broad, coriaceous with fine punctures as on the thorax. Abdomen parallel, closely finely and rather roughly punctured on the first two visible tergites, gradually less roughly towards apex, finely coriaceous. Pubescence on fore-parts fine, coarser on the abdomen.

New Zealand: Otago (*Fulton*). Unique. British Museum.

Euryusa aliena, sp. n.

Parallel, moderately shining, the fore-parts light reddish brown, the abdomen darker with the posterior margins of the tergites rufescent. Antennæ red, the first three and the 11th segments reddish yellow. Legs reddish yellow. Length 4.5 mm.

Head narrower than the thorax (2:3.2), feebly bi-impressed behind the antennæ, with close rather coarse puncturation at the sides but much more sparing along the middle, the front smooth, the ground-sculpture fine and coriaceous. Antennæ short and stout. 2nd and 3rd segments of equal length, 4th to 10th transverse, increasing in width, the penultimate three times broader than long, 11th stout. Thorax transverse (3.2:2.5), convex, the sides evenly rounded, a little more retracted towards the front, with similar but closer puncturation to the head; ground-sculpture absent. Elytra longer (3:2.5) and slightly broader than the thorax (3.5:3.2), slightly broader than long (3.5:3), deeply emarginate postero-externally, the sculpture very similar. Abdomen parallel, rather finely, moderately closely punctured throughout, more coarsely in the impressions; ground-sculpture absent. The whole insect with rather long and close yellow pubescence.

♂: 7th tergite with a pair of lightly curved ridges enclosing an oval space in the whole length of the segment: 8th very feebly emarginate. Elytra on each side of suture with a sharp ridge except at the base.

This species has a narrower thorax than in typical forms of *Euryusa*, and the mesosternum has a feeble keel,

the structure of the mouth-parts and tarsi are, however, similar.

New Zealand : Greymouth, 15. 1. 08 (Type); Barnslaw, 6. 2. 14. British Museum.

MYRMEDONIINI.

GALAFRIA, gen. nov.

Distinct amongst the *Falagriates* by the strongly-keeled mesosternum, its process narrow and acute. Neck very narrow, about one-sixth the width of the head. Temples not bordered below, the gular sutures diverging in front. Labrum transverse, the anterior border gently rounded. Maxillary palpi with the 3rd segment a little longer and distinctly thicker at the apex than the 2nd, 4th subulate, about half as long as 3rd. Mentum transverse, trapezoidal, the anterior border truncate. Labial palpi with the first two segments rather short, subequal, 3rd much more slender, about as long as the 1st and 2nd together. Tongue narrow, split nearly to the base into two narrow slightly diverging lobes. Prosternum largely developed. Pronotal epipleura visible from the side. Mesosternum strongly carinate, its process narrow and acute, extending nearly the whole length of the coxæ which are narrowly separated. Elytra emarginate postero-externally. Abdomen with the first four visible tergites transversely impressed at base. Sternites not modified. Legs rather long. Tarsi 4, 5, 5, the anterior with the first three segments short and subequal, 4th as long as the three preceding together; middle with the 1st segment slightly longer than the 2nd, 2nd to 4th short, subequal, 5th as long as 2nd, 3rd and 4th together; posterior with 1st segment scarcely as long as the 2nd and 3rd together, 2nd to 4th short, subequal, 5th as long as 2nd, 3rd and 4th together.

Galafria rufa, sp. n.

Shining red, the elytra lighter. Antennæ and legs reddish yellow. Length 3 mm.

Head a little longer than broad, obovate, as broad as the thorax, the eye about a third as long as the strongly retracted post-ocular region, the punctures small, few and scattered. Antennæ rather slender, the 3rd segment as long as the 2nd, 4th to 9th all longer than broad,

decreasing in length, the 10th as long as broad, 11th as long as the 9th and 10th together. Thorax longer than broad (4 : 3), the sides rounded and wider before the middle, from thence strongly retracted to the narrow neck in front, less strongly retracted and slightly sinuate behind; in the posterior half on each side with a large oval fossa; punctures few, small, obsolete and scattered. Scutellum finely coriaceous. Elytra longer (5 : 4) and broader than the thorax, as long as broad, practically impunctate. Abdomen parallel, scarcely widened at apex, the 1st visible tergite with a median keel, impunctate, the posterior margins of the anterior tergites with yellow hairs. The whole insect, except for the scutellum, without ground-sculpture and practically glabrous.

New Zealand: Howick. — xii. 1885. Unique. British Museum.

ECOMORYPORA, gen. nov.

In build much resembling *Myrmecopora* Saulcy, the neck narrow as in that genus and the structure of the mouth parts and tarsi very similar, but the first four visible tergites transversely impressed at the base, the mesosternum with a fine keel more marked on the process, and the middle coxæ contiguous behind. In other respects similar.

Type of genus *Myrmecopora granulata* Broun.

PYROMECROMA, gen. nov.

Except for the broader neck, much resembles *Myrmecopora* Saulcy in build, but the legs are shorter, the 1st segment of the posterior tarsi only as long as the 2nd and 3rd together, the tongue undivided. Head transverse, subquadrate, the neck stout (3 : 5), temples not margined. Labrum transverse, truncate; mandibles edentate; maxillary palpi with the 3rd segment a little longer and stouter at apex than the 2nd, 4th small, subulate, scarcely one-fifth as long as 3rd; labial palpi with the first two segments of equal length, stout, the 3rd as long as the 2nd but thinner; tongue as long as the 1st segment of the labial palpi, narrow and parallel and apparently undivided at apex. Pronotal epipleura large and visible from the side. Mesosternum simple, coxæ contiguous. Abdomen with first three visible tergites transversely

impressed at base, the sternites not constricted or impressed. Elytra scarcely emarginate postero-externally. Tibiæ finely pubescent. Tarsi 4, 5, 5, the anterior short, the first three segments short and equal, 4th rather longer than the preceding together: middle with first four segments short, subequal, subtriangular, the 5th as long as 2nd to 4th together: posterior with the 1st segment as long as 2nd and 3rd together, 2nd to 4th subequal, 5th scarcely as long as the 1st.

Type: *Myrmecopora funesta* Br. The fine close white pubescence suggests a maritime habitat.

Atheta (s.str.) *cottieri*, sp. n.

Moderately shining: head and abdomen pitchy, the first three and last tergites obscure yellowish brown; thorax yellowish red; elytra brownish yellow. Antennæ black, the first two segments and legs reddish yellow. Length 2.2 mm.

In build and lustre much like *oblita* Er.; differs in the colour, the 4th segment of the antennæ as long as broad, the eyes smaller. Head transversely suborbicular, narrower than the thorax, the eyes a good deal shorter than the rounded post-ocular region, the sculpture much weaker than in *oblita*, the puncturation extremely fine and confused with the very fine ground-sculpture. Antennæ with the 3rd segment as long as the 2nd, 4th as long as broad, 5th to 10th gradually more transverse, the penultimate about a half broader than long. Thorax transverse (3.75:3), the sides gently rounded and a little retracted behind, in the middle of the posterior half with a weak impressed line, the sculpture as on the head. Elytra longer (3.75:3) and broader than the thorax, transverse (4.5:3.75) with very fine rather close asperate punctures, much finer than in *oblita*, the ground-sculpture extremely fine. Abdomen a little narrowed at the apex, very finely, moderately closely punctured on the first three visible tergites, more sparingly on the following, the ground-sculpture fine and transverse. Pubescence throughout fine and yellow.

New Zealand: Palmerston. In dry rot on swede. Feb. 1930 (W. Cottier). Unique. British Museum.

Homalota coriaria Broun in litt. = *Gnypeta fuscicornis* Br.

Atheta (Liogluta) plicata, sp. n. (Broun in litt.).

Rather shining; head black, thorax light reddish brown, elytra brownish yellow, abdomen reddish brown, the 4th visible tergite black. Antennæ black, the first two segments and legs reddish yellow. Length 4 mm.

In colour and build much like *pagana* Er., but the antennæ shorter and stouter, the penultimate segments transverse; eyes larger, head more distinctly punctured; thorax rather more closely punctured; elytra in ♂ with close fine granular sculpture, in ♀ more fine and scarcely granular; abdomen rather more finely punctured: the ground-sculpture scarcely differs in the two species. Antennæ with the 2nd and 3rd segments of equal length, 4th slightly longer than broad, 5th and 6th as long as broad, 7th to 10th slightly transverse, 11th as long as the 9th and 10th together.

♂: 2nd and 3rd tergites with a broad superficial transverse impression at the bases: 5th with median keel, on each side with a few interrupted ridges or tubercles: 6th rounded and obscurely crenulate, on each side with a small tooth separated by a small rounded emargination from the central plate.

New Zealand: Hunua, Maketu.

Atheta (Acrotona) zealandica, sp. n.

Moderately shining, black, the elytra brownish yellow. Antennæ black, the first two segments and legs reddish yellow. Length 2.2-3 mm.

Colour and build of *fimorum* Bris., but larger, the antennæ similarly constructed but much stouter, the ♂ with characters much like those of *laticollis* Steph. The puncturation of the head and thorax scarcely differs from that of *fimorum*, but the ground-sculpture is stronger: thorax with feeble impression before the scutellum; the elytra finely but more closely and roughly punctured than in *fimorum*, the ground-sculpture fine and coriaceous, the sculpture of the abdomen scarcely differs from that species. Tibiæ without setæ.

♂: 8th tergite with four processes on the posterior margin, the middle pair stouter than in *laticollis* and with rounded apices, the lateral processes shorter and

stouter than in that species, not extending beyond the level of the median pair: 8th sternite rounded.

♀: 8th tergite with shallow arcuate emargination.

New Zealand: Palmerston. In dry rot lesions on swede, Feb. 1930 (*W. Cottier*). Type in British Museum. Co-type in my collection.

TRAMIATHÆA, gen. nov.

In build much resembling *A. (Hypatheta) incognita* Shp., but larger and more robust than that species, and with the labial palpi of two segments only must be included in the *Schistogeniæ*. Head exserted, a little constricted behind, the neck broad. Temples bordered below. Labrum truncate, the anterior angles rounded. Mandibles edentate. Inner lobe of maxilla pointed with some fine spines near apex, finely ciliated posteriorly; outer lobe broader, membranous at apex and covered with fine short hairs. Maxillary palpi with 1st segment small, 2nd elongate, curved, and a little thickened towards apex, 3rd a little longer than 2nd and gradually broader toward apex, 4th subulate, half as long as 3rd. Mentum transverse, trapezoidal, truncate in front. Labial palpi 2-segmented, the 1st cylindrical, elongate, 2nd as long as 1st but narrower, a little widened towards apex. Tongue split to the middle into two narrow parallel lobes, as long as the 1st segment of the labial palpi. Paraglossæ extending for about half the length of the labial palpi. Pronotal epipleura visible from the side. Prosternum transversely sulcate behind the anterior border, the posterior deflexed part keeled along the middle. Mesosternum simple, its process short, extending about half the length of the coxæ, the apex truncate and separated by a short intersternal piece from the bluntly pointed metasternal process, the coxæ moderately separated. Abdomen with the first three sternites transversely impressed at the base, the first three tergites also. Elytra emarginate postero-externally. Tibiæ pubescent. Tarsi 4, 5, 5, the anterior with the first three segments short, subequal, the 4th longer than the preceding together: middle with the first two segments rather short, equal, 3rd and 4th a little longer, equal, 5th as long as the four preceding together; posterior with 1st segment a little

shorter than 2nd, 2nd to 4th of equal length, 5th about as long as 2nd, 3rd and 4th together.

Type of genus *Homalota cornigera* Broun. To his description of the ♂ characters must be added those of the 8th tergite, which is truncate and crenulate, on each side with a small blunt but prominent tooth. In the ♀ the posterior margin of the 8th tergite is gently rounded.

OXYPODINI.

DASYNOTUS Broun.

Of the species described by Broun as belonging to this genus, *flavescens*, *optabilis*, *ararius*, *thoracicus* and *fulgens*, the first four were referred to *Calodera* Mannerh. by Fauvel (Rev. d'Ent. iv. 1885, p. 312); they differ, however, from that genus in the facies, sculpture and long coarse pubescence, and moreover the 1st segment of the posterior tarsi is much shorter than the last and the anterior angles of the mentum are distinctly produced and prominent: subsequently Broun described as *Calodera sericophora*, *granifer*, *diversa*, *vestita*, *tumidella*, *bituberculata*, *fungicola* and *algophila*: of these the first seven are certainly congeneric with *Dasynotus*, *fungicola* is an *Ocalea* and *algophila* requires a new genus. Taking *flavescens* as the type of the genus, the following characters may be noted:—Head exserted, transversely subquadrate, the posterior angles rounded, the neck stout, the temples not bordered, antennæ strongly incrassate. Labrum transverse, truncate, mandibles prominent, edentate: maxillary palpi with the 3rd segment longer and a good deal thicker at apex than the 2nd, 4th subulate, about half as long as the 3rd. Mentum transverse, trapezoidal, the anterior angles produced and prominent: labial palpi with the 1st two segments cylindrical, of equal length, 3rd as long as the 2nd but much narrower. Pronotal epipleura distinctly visible from the side: mesosternum not carinate, its process acute, extending nearly whole length of coxæ and almost meeting the metasternum, the coxæ narrowly separated. Elytra broader than the thorax, deeply emarginate postero-externally: scutellum rugose. Abdomen parallel, the first four visible tergites transversely impressed at base, the first three sternites also. Anterior and middle tarsi with the first

four segments short and subequal, the 5th longer than the preceding together: posterior very similar, the 5th much longer than the 1st, as long as the preceding together. Ground-sculpture entirely absent, except on the 7th or 7th and 8th tergites. *Fulgens* is also a *Dasynotus*.

Dasynotus bifossula, sp. n.

(*Calodera bifossula* Br. in litt.)

Size, colour and lustre of *sericophora* Br. and, except for the slightly narrower head, similar in build, the antennæ similarly constructed, but distinct in the much finer and more obsolete puncturation of the fore-parts and the 7th tergite (and apparently the 8th) with numerous small scattered granules, this also coriaceous as in *sericophora*: the thoracic fossæ are not quite so deep as in that species. Length 3 mm.

Greymouth. Unique. British Museum.

EURYNOTUS, gen. nov.

The type of this genus is *Gyrophæna rufipennis* Broun, referred by Fauvel to *Calodera* Mannerh., but differing in several respects from that genus and more like *Dasynotus*, which it resembles in the complete absence of ground-sculpture (including the 7th and 8th tergites) and the long pubescence. In build and size much like *Euryalea decumana* Er. Head exerted, neck stout. Temples not margined below. Labrum transverse, truncate. Mandibles not produced, edentate. Maxillary palpi with the 3rd segment a little longer than the 2nd and a little thicker at apex, 4th subulate, half as long as the 3rd. Labial palpi with the 1st segment rather short, cylindrical, 2nd scarcely half as long, 3rd narrow, as long as the 1st and 2nd together. Tongue narrow, parallel, as long as the 1st segment of the labial palpi, split at apex with two small slightly divergent lobes. Pronotal epipleura distinctly visible from the side. Mesosternum without keel, its process short, rounded at apex and extending about half the length of the coxæ, separated from the metasternum by a short intersternal piece, the coxæ rather widely separated. Scutellum rugose. Elytra

emarginate postero-externally. Abdomen with the first four visible tergites deeply transversely impressed at base, the anterior sternites not impressed. Tibiæ without spines. Tarsi 5, 5, 5, the anterior short, the 5th segment longer than the preceding together; middle with the first four segments rather short, 5th as long as 2nd, 3rd and 4th together; posterior with the 1st segment rather short, 2nd, 3rd and 4th of equal length, each a little longer than the 1st, 5th as long as the 2nd, 3rd and 4th together, much longer than the 1st.

CALONOTUS, gen. nov.

Allied to *Calodera* Mannerh. and *Dasynotus* Broun. differs from both in the temples bordered behind, the 1st and 2nd segments of the labial palpi very short and stout, scarcely longer than broad, the 3rd short and slender. From *Dasynotus* it differs in the elytra scarcely emarginate postero-externally, different abdominal sculpture, the 7th tergite not coriaceous, the 1st segment of the posterior tarsi longer, as long as the 2nd and 3rd together but shorter than the 5th. From *Calodera* also in the shorter posterior tarsi, the 5th segment longer than the 1st. The type of this genus is *Calodera algophila* Broun.

MAORIA, gen. nov.

In build, except for the longer elytra, somewhat like *Atheta* (*Thinobaena*) *vestita* Gr., the superficial puncturation of the head and thorax very similar. Temples gradually retracted behind and completely bordered below, the neck moderate. Pronotal epipleura visible from the side. Prosternum keeled. Mesosternum simple, its process acute, extending half the length of the coxæ, these narrowly separated. Metasternal process short, acute and separated from the mesosternum by a long intersternal piece. Abdomen with the first three visible tergites transversely impressed at base, the sternites not constricted. Labrum subquadrate, slightly transverse, the anterior angles rounded, in the middle very slightly arcuately emarginate and membranous. Mandibles moderate, acute, edentate. Outer lobe of maxilla longer than the inner, membranous at apex and closely ciliate, the inner pointed, the internal margin with long close

cilia. Maxillary palpi with the 1st segment small, 2nd elongate, slightly curved and thickened towards apex, the 3rd as long as the 2nd and more strongly widened apically, the 4th short, conical. Mentum transverse, truncate in front, trapezoidal. Labial palpi with the 1st segment moderate, 2nd a little shorter and narrower, 3rd yet narrower and about as long as the 1st. Tongue moderately broad, as long as the 1st segment of the labial palpi, slightly widened towards apex which is arcuately emarginate. Tibiæ ciliate. Tarsi 5, 5, 5, the anterior with the first four segments rather short, subequal, the 5th nearly as long as the preceding together; middle with 1st segment rather short, 2nd slightly longer, 3rd a little shorter than 2nd, 4th longer, fully as long as 2nd, 5th as long as the three preceding together; posterior as long as the tibia, the first four segments rather long, equal, 5th as long as the 3rd and 4th together, much longer than the 1st. Would appear to be allied to *Calodera* Mannerh., the build and general facies somewhat similar.

Maoria hudsoni, sp. n.

Shining, black. Antennæ black, the first four segments and legs reddish yellow, the femora and 3rd segment of the maxillary palpi infusate. Length 3.5 mm.

Head transversely suborbicular, a little narrower than the thorax, eyes moderate, shorter than the post-ocular region, with moderately close superficial flat punctures and fine coriaceous ground-sculpture. Antennæ with the 1st and 2nd segments of equal length, 3rd a little shorter, 4th and 5th as long as broad, 6th to 10th gradually more transverse, the penultimate about a half broader than long, the 11th scarcely as long as the 9th and 10th together. Thorax slightly transverse (2.5:2), the sides gently rounded in front, straighter and more retracted behind, the posterior angles rounded, before the scutellum with a fovea; sculpture as on the head. Elytra longer (2.5:2) and broader than the thorax, transverse (3.5:2.5), slightly emarginate postero-externally, the sculpture very similar to that of the thorax. Abdomen slightly narrowed at the apex, the first three visible tergites rather closely punctured at the base with flat superficial punctures,

elsewhere more sparingly and normally, the ground-sculpture coriaceous.

♂: 7th tergite in the posterior half with a strong median keel; 8th with a median keel and numerous granules, the posterior margin arcuately emarginate and furnished with five little tubercles, the central one the largest. 1st sternite with the superior angle a little prominent and produced slightly backwards.

New Zealand: Mt. Aurum, Lake Makatipu (G. V. Hudson). Type in my collection.

Gyrophæna socialis Broun is an *Ocalea* Er.

Calodera fungicola Broun (*Ocalea fungorum* Broun in litt.) is an *Ocalea*.

Ocalea brouni, sp. n.

Very near *socialis* Broun but narrower, the head, thorax and elytra more closely and less finely punctured, the puncturation at the bases of the tergites much closer and coarser, the abdomen pitchy, only the posterior half of the 5th visible segment and the last reddish yellow; in all other respects like *socialis*. Length 3 mm.

New Zealand: Taranaki.

Ocalea (Tetrocalea) suturalis, sp. n.

Calodera suturalis Broun in litt.

Shining; head blackish; thorax lighter or darker reddish brown; elytra pitchy, on each side of the suture with indeterminate oval reddish-yellow marking, not extending to the base; abdomen black, the posterior margins of the 7th and 8th tergites reddish yellow. Antennæ dark, the first four segments and legs reddish yellow. Length 3 mm.

Except for the stouter neck, much resembles *Blepharymenus corsicus* Rey. in build. Head suborbicular, as broad as the thorax, the eyes moderate, the post-ocular region feebly rounded and distinctly retracted to the neck, finely bordered below, puncturation fine, moderately close. Antennæ long, the first three segments of equal length, 4th a little shorter, 5th to 10th all longer than broad, the 10th only slightly, 11th as long as the 9th and 10th together. Thorax as long as broad, the sides rounded and retracted in front, slightly sinuate and less

retracted behind, the posterior angles obtuse, before the scutellum with a transverse impression, the puncturation much like that of the head. Elytra ample, a good deal longer (7:4) and broader than the thorax, as long as broad, slightly emarginate postero-externally, more closely and less finely punctured. Abdomen a little narrowed towards apex, coarsely and closely punctured in the impressions, more finely and less closely elsewhere, the pubescence long and yellow, much closer at the sides of the segments. The fore-parts with moderately close pubescence. Ground-sculpture throughout absent.

New Zealand: Arthur's Pass (Type), Wakalipu (G. V. Hudson); Midhurst, Reefton (Broun). Type in my collection.

Ocalea (Tetrocalea) hudsoni, sp. n.

Shining: fore-parts dark reddish brown, abdomen black, the lateral and posterior margins of the tergites reddish. Antennæ red, the first four segments reddish yellow. Legs yellowish red. Length 6 mm.

Larger than *suturalis* Cam., differently coloured, the antennæ stouter, thorax broader, more strongly punctured. Head suborbicular, slightly narrower than the thorax, the eyes small, shorter than the retracted post-ocular region, puncturation fine, obsolete, moderately close. Antennæ with the first three segments elongate, equal, 4th to 10th gradually decreasing in length, the penultimate scarcely longer than broad. Thorax as long as broad, the sides straight, parallel, before the scutellum with a fovea, rather closely, less finely and much more distinctly punctured than the head. Elytra longer (4.75:2.75) and broader than the thorax, as long as broad, finely and closely punctured. Abdomen as in *suturalis*; the pubescence as in that species and ground-sculpture absent.

New Zealand: Arthur's Pass (Hudson). Type in my collection.

Tetrocalea rufa, sp. n.

Shining red; antennæ and legs reddish yellow. Length 4 mm.

Larger and more robust than *suturalis* Cam., the post-ocular region more rounded, puncturation of thorax less fine and closer, that of the elytra also closer, abdomen

with coarser sculpture in the impressions and also on the 5th visible tergite. In all other respects similar.

New Zealand: Otago. Unique. British Museum, Broun collection.

Tetrocalea abdominalis, sp. n.

Shining, head black, thorax reddish brown: elytra brownish yellow, infuscate postero-externally: abdomen red, the 4th and base of 5th visible tergites blackish. Antennæ brown, the first three segments and legs reddish yellow. Length 3 mm.

A little narrower than *suturalis* Cam., but of similar build, differs in the colour and rather more finely and more closely punctured elytra, in other respects similar.

New Zealand: Waimarino. xii. 1909. British Museum, Broun collection.

Ischnoglossa pectinata, sp. n. (Fauvel in litt.).

Colour and lustre of *bituberculata* Broun (described as a *Calodera*), the antennæ similar, but of more robust build, the head larger, the eyes smaller, but the sculpture scarcely differing: the thorax is distinctly broader (4.2: 3), much more distinctly and closely punctured, the coriaceous ground-sculpture stronger: the elytra longer (4: 3) and a little broader than the thorax, broader than long (5: 4), more closely punctured than in *bituberculata* and without basal tubercles: the puncturation of the abdomen is finer and closer than in that species and not asperate, finely coriaceous, the 7th tergite in both sexes with numerous granules.

♂: 8th tergite with the posterior margin gently rounded and furnished with six rather long closely placed teeth, and on each side a slender incurved spine separated by a small arcuate emargination from the central teeth.

♀: 8th tergite gently rounded and finely and closely denticulated, the teeth much shorter than in the ♂.

New Zealand: Helensville, Kaipara. Type in British Museum.

Ischnoglossa rufa, sp. n.

Ischnoglossa brachyptera Fauv. in litt.

Shining red, the elytra yellowish red. Antennæ and legs reddish yellow. Length 2 mm.

A small narrow parallel species. Head round, narrower than the thorax, the eye as long as the post-ocular region, coriaceous and impunctate. Antennæ with the first three segments of equal length, 4th to 10th transverse, increasing in width, the 10th nearly twice as broad as long. Thorax slightly transverse (3·3 : 3), the sides feebly rounded in front, straight and a little retracted behind, the posterior angles obtuse, at the middle of the base with a small transverse impression; sculpture consisting of very small close granules, ground-sculpture absent. Elytra longer (4 : 3) than the thorax and a little broader, with similar but finer and less close sculpture and without ground-sculpture. Abdomen parallel, the first two visible tergites with fine close granular sculpture, the 3rd to 6th gradually more sparing and less granular, the first four without ground-sculpture, the 5th finely but distinctly coriaceous, the 8th with the posterior margin truncate, finely and obsoletely crenulate.

New Zealand: Greymouth (*Helms*). Unique. British Museum.

Ischnoglossa parvicentris, sp. n. (Broun in litt.).

Moderately shining, head darker, thorax and abdomen lighter red, the base of the 4th visible tergite blackish; elytra yellow. Antennæ and legs reddish yellow. Length 1·5 mm.

Smaller and narrower than *rufa* Cam., but of similar build, the head more shining, finely coriaceous and with moderately close small superficial punctures, the eyes smaller. Antennæ as in *rufa*, but with the penultimate segments more transverse. Thorax with small impression before the scutellum, the ground-sculpture fine but distinct and with moderately close fine simple puncturation. Elytra with close fine somewhat asperate puncturation, as in *rufa*. Abdomen finely and sparingly punctured, except in the impressions where the punctures are coarser and closer, the ground-sculpture fine, coriaceous.

In the unique specimen the 8th tergite is not visible.

New Zealand: Hunua, Maketu. Type in British Museum.

BROUNIA, gen. nov.

Remarkable amongst the *Oxyrodini* in the structure of the mouth-parts, the labial palpi being long and

styliform, as in *Diestota* and *Plagiusa*. In general facies much resembling a *Tachyusa* (Ischnopoda).

Head subquadrate, strongly constricted behind, the neck about a fourth its width. Temples not bordered below. Labrum slightly transverse, the anterior angles rounded, the anterior border truncate. Mouth-parts prominent, mandibles narrow, elongate, edentate. Maxillary palpi with the 1st segment small, 2nd lightly curved and a little thickened towards apex, 3rd about as long but thicker apically, 4th subulate, about half as long as 3rd. Inner lobe of maxilla narrow, membranous, as long as the outer, the apex finely ciliate; outer lobe narrow, corneous, the apical half with close spines internally decreasing in length towards the apex. Mentum transverse, trapezoidal, the anterior border truncate, the anterior angles a little produced. Labial palpi styliform, extending beyond the apex of the mandibles, unsegmented. Tongue very narrow, undivided, extending nearly to the apex of the mandibles, more than half the length of the palpi. Pronotal epipleura plainly visible from the side; prosternum well developed, the posterior declivous part strongly carinate in the middle. Mesosternum simple, its process narrow and narrowly sulcate on each side, bluntly pointed and extending nearly the whole length of the coxæ, which are narrowly separated: metasternal process rounded at apex and separated from the mesosternum by a short intersternal piece. Elytra slightly emarginate postero-externally. Abdomen parallel, the first three visible tergites transversely impressed at base. Legs moderate, the tibiæ ciliate. Tarsi 5, 5, 5, the anterior with the first four segments short, equal, the 5th rather longer than the preceding together; middle similar; posterior rather more than half the length of the tibia, the 1st segment rather short, slightly longer than the 2nd, 2nd to 4th short, subequal, 5th slightly longer than the preceding together.

Brounia vulcanica, sp. n.

(*Calodera vulcanica* Broun in litt.).

Greasy lustrous, elytra and abdomen more shining; head black, thorax and abdomen darker, elytra lighter

ferruginous red, the 4th visible tergite a little infusate at the base. Antennæ black, the first three segments and legs reddish yellow. Length 3 mm.

Head transverse, subquadrate, a little narrower than the thorax, the posterior angles rounded, eyes moderate, shorter than the post-ocular region, on the middle of the disc with a small impression, coarsely coriaceous, impunctate. Antennæ rather long and stout, 2nd and 3rd segments of equal length, longer than the 1st, 4th to 7th a little longer than broad, decreasing in length, 8th to 10th as long as broad, 11th as long as the 9th and 10th together. Thorax as long as broad, the sides rounded in front, straight and rather strongly retracted behind, the posterior angles rounded, along the middle superficially and narrowly impressed, the sculpture as on the head. Scutellum closely granular. Elytra longer (2.75 : 2) and broader than the thorax, slightly transverse (3 : 2.75), with rather large, moderately close punctures, the ground-sculpture very finely granular. Abdomen practically parallel, the bases of the first three visible tergites closely and rather coarsely punctured, elsewhere more sparingly and finely; ground-sculpture absent.

♂. 8th tergite at the middle of the posterior margin with five or six closely placed spines, the three central ones with a little tubercle at the base of each; externally on each side with a longer spine slightly curved inwards; 6th sternite produced and narrowed to an acute point.

New Zealand: Makara (Type) (*G. V. Hudson*). Epsom, Howick. Hunua Makratu: Ngatira Rotorua (*Brown*). Type in my collection.

Brounia lucida, sp. n.

Colour and build of *vulcanica* Cam., but a little smaller (2.75 mm.) and narrower and shining, the whole insect without ground-sculpture: head and thorax extremely finely, moderately closely punctured. Antennæ as in *vulcanica*: puncturation of elytra similar. Abdomen with the basal impressions more finely and less closely punctured. Pubescence fine, moderately close and outstanding, as in *vulcanica*.

New Zealand: Rangitoto, 28 . x . 12. Unique. British Museum.

ADDENDUM.

Omalius (s. str.) *helmsi*, sp. n. (Fauv. in litt.).

Rather shining, black, the thorax dark reddish brown. Antennæ with the first five segments reddish yellow, the rest black. Legs reddish yellow. Length 3.5 mm.

Size and build of *riparium* Thoms., but with the penultimate segments of the antennæ more transverse, the sculpture of the head scarcely differing, the thorax a little narrower, more convex and without median impression in front, the lateral impressions less marked, the punctures of about the same size but more uniformly distributed, the ground-sculpture distinct, not coriaceous but more or less transverse and wavy. Elytra twice as long as the thorax, the puncturation rather finer and closer than in *riparium*, not at all rugulose; ground-sculpture absent. Abdomen finely and rather closely punctured, the ground-sculpture not coriaceous as in *riparium* but wavy and transverse.

Wellington (Type). Mount Hutt. Otago: a specimen from this locality has the ground-sculpture much less evident than in the other examples. Type in the British Museum.

MACRALYMMMA, gen. nov.

Near *Micralymma* Westw. but parallel, the elytra longer, the thorax bisulcate, mandibles edentate, the tibiæ finely spinose, but in other respects similar and like it of maritime habitat.

Macralymma punctiventris, sp. n.

. *Phlaeonæus punctiventris* Br. in litt.

Shining, entirely reddish yellow. Antennæ and legs. reddish yellow. Length 2.5 mm.

Head narrower than the thorax, the eyes large, temples very short, ocelli small, situated in a short depression, in front and along the middle practically impunctate, at the sides with a few small punctures; ground-sculpture wavy, transverse in front, more or less longitudinal near the eyes. Antennæ with the 1st segment stout, 2nd and 3rd more slender and shorter, 4th and 5th orbicular,

6th to 10th distinctly transverse and differing little. Thorax transverse (4.5 : 3.5), the sides rounded in front, straighter and distinctly retracted behind, the posterior angles rounded : disc with a groove on each side of the middle for practically the whole length, each with a row of small punctures, at the sides with scattered punctures larger than those of the head ; ground-sculpture coriaceous. Elytra longer (5 : 3.5) and broader than the thorax, as long as broad, the punctures as large but more superficial than those of the thorax and about as close ; ground-sculpture scarcely visible. Abdomen parallel, the side-margins vertical, rather coarsely and closely punctured, coriaceous.

New Zealand : Taieri Beach. Type in British Museum.

XVI.—*New and little-known African Bees of the Subfamily Anthidiinæ (Apoidea).—Part IV.* By G. A. MAVROMOUSTAKIS, Limassol, Cyprus.

Anthidium niveocinctum Gerst.

N. RHODESIA : Abercorn, May 1944, many females and males (H. J. Bredo).

Anthidium severini Vachal, subsp. *melanaspis* Ck'l.

Anthidium severini Vach. var. *maximum*, ♂, G. A. Mavromoustakis, in *Ann. & Mag. Nat. Hist.* (10) xvii. p. 35, 1936.

Anthidium sudanicum, sp. n. (Fig. 1.)

Male. Length 11 mm.

Black ; clypeus shining, somewhat strongly and sparsely punctured, towards apical margin and lower sides densely punctured ; mandibles except the apex cream ; vertex somewhat strongly and very densely punctured, dull ; scape and three basal joints of flagellum dark brownish black, rest of flagellum brown ; distance between lateral ocelli and top of eyes longer than distance between top of eyes and occiput ; clypeus, base of supraclypeal area transversely, lateral face-marks filling space between clypeus and eyes and reaching level of insertion of antennæ, and entire occipital stripe, all creamy yellow ; face below middle ocelli, sides of face, supra-

clypeal area, and cheeks, with greyish hairs ; apical margin and sides of clypeus with white hairs ; vertex and occiput with shorter and more sparse greyish hairs. Mesonotum somewhat strongly and very densely punctured, the punctures shining, the intervals dull ; scutellum projected, sides obtuse, apical margin subemarginate in middle, sharply edged and subhyaline ; area of metathorax dull, very finely and very densely coriaceous, with very dense rugose punctures at sides above, tegulae with punctured disk, apical margin brown, pale subhyaline in front and behind, otherwise disk brownish black and with a cream mark in front and behind ; tubercles cream ; an L-shaped stripe on each side of mesonotum not reaching axillae, subapical margin of scutellum slightly interrupted in

Fig. 1.



Sixth and seventh tergites of *Anthidium sudanicum*, sp. n., ♂.

middle, all creamy yellow ; wings nearly clouded, marginal cell clouded above ; second recurrent nervure slightly out of second transverse cubital nervure ; first cubital cell sufficiently smaller than second ; mesonotum with short yellowish-grey hairs (mostly rubbed) ; thorax with greyish hairs at sides ; femora red-brown, anterior and middle ones with creamy-yellow stripe beneath ; tibiae creamy yellow above and red-brown beneath ; tarsi deep red-brown, with white hairs on outer side ; spurs pale yellow ; apex of claws black ; pulvilli absent. Abdomen light red-brown, shining ; first and second tergites with lateral large yellow marks ; third tergite with broad basal yellow stripe interrupted in middle ; fourth tergite with basal half yellow, the yellow nearly covering sides ; fifth and sixth tergites with the exception of apical margin narrowly at sides and broadly in middle, yellow ; seventh tergite yellow ; sixth tergite with lateral short spine, without incision ; seventh tergite bilobed and between the lobes a round emargination truncate above (fig. 1) ; first tergite with lateral somewhat strong punctures, base

narrowly somewhat strongly punctured, rest of disk with sparse somewhat fine punctures, very sparse towards apical margin in middle, apical margin impunctate; second tergite somewhat strongly punctured at sides, basal half with somewhat strong and regular sparse punctures in middle, disk towards apical margin with very sparse fine punctures in middle, apical margin impunctate; ventral segments with yellow-white hairs.

Female. Length 11 mm., breadth of abdomen 5.5 mm.

Similar to the *male*; clypeus creamy yellow, shining, somewhat strongly punctured, somewhat sparsely in middle, apical margin brownish black, impunctate transversely and narrowly convex and crenulated; a small cream mark on each side of face reaching only lower sides of clypeus but not the inner orbits; a narrow cream stripe on each side of occiput; vertex and occiput densely punctured and dullish; all frons, supraclypeal area, face laterally, densely covered with dull greyish-white hairs; clypeus with shorter and sparse similar hairs; vertex and occiput with short somewhat erect dull greyish-white hairs; scape black, apex very narrowly reddish brown, flagellum black-brown above, joints 1 to 3 brown beneath, fourth and fifth joints yellowish brown beneath; second joint of flagellum longer than third or fourth, but somewhat shorter than 3+4; mandibles creamy yellow, with six large teeth and a smaller one, apex and teeth black-brown with a reddish-brown suffusion. Thorax black; mesonotum with short dull yellowish-grey bristles, somewhat dense in front; thorax with dense dull yellowish-grey hairs at sides; axillæ with a mark, scutellum with a narrow subapical slightly interrupted stripe, creamy yellow; tubercles brownish black; wings clouded; femora dark reddish brown, with base yellow above and with a creamy-yellow stripe beneath on anterior and middle ones; tarsi with basitarsi densely covered with dull yellow-grey hairs above, hind basitarsi densely covered with light reddish-brown hairs on inner side, small tarsal joints dark brownish black, apical joint brown. The lateral yellow mark on second tergite forming entire basal stripe; third tergite with basal entire yellow stripe broader at sides; fourth and fifth tergites with basal broad stripe somewhat attenuated towards middle and nearly covering sides (except narrowly

the apical margin), yellow; sixth tergite nearly yellow, except two reddish-brown spots on each side of middle of disk, apical margin irregularly subcrenulated; first tergite with somewhat dense white hairs at sides and sparse similar in base; fourth and fifth tergites with a row of rather sparse whitish bristles; sixth tergite with somewhat dense light yellowish-white bristles; ventral segments yellow-brown; scopa white, hairs of sixth sternite light golden.

SUDAN: Nuer District, 1 ♂ (type), 1 ♀ (allotype), 7. ix. 23 (V. H. Fergusson); the male type belongs to Agricultural Research Institute, Wad-Medani, Sudan, and will be placed in the British Museum.

Anthidium sudanicum, sp. n., differs from *Anthidium opacum* Friese, from West Africa, in many details. *Anthidium opacum* has the scutellum convex and rounded at sides, well produced, apical margin emarginated in the middle but not membranously prolonged, and this species stands very near to *Anthidium severini* Vachal, with a similar scutellum. *Anthidium soni* Mavrom., from South Africa, is larger and has large sparse and very shallow punctures on mesonotum, the abdomen is otherwise coloured and punctured, and has a quite different form of sixth and seventh tergites (Ann. Transv. Museum, xviii, p. 2). *Anthidium ko rouri* Br., from South Rhodesia and Transvaal, with also bilobed seventh tergite, has the scutellum projected, apical margin truncate, slightly emarginated in middle and slightly sharply edged, but without the pale subhyaline prolongation of apical margin, as it happens in *Anthidium sudanicum*. *Anthidium kohrowi* has fifth sternite emarginated in the middle of apical margin, the area of metathorax finely coriaceous, sparsely and shallowly punctured and with the punctures shining. *Anthidium sudanicum* has fifth sternite with entire apical margin, the area of metathorax very finely coriaceous and with very dense rugose punctures at sides above, and everywhere dull.

Anthidium ochrognathum Alfken.

SUDAN: Khor Arbaat Delta, 1 ♂, 4. v. 26 (H. B. Johnston), visiting the flowers of a dwarf heliotrope.

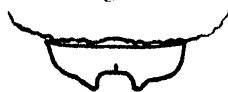
Flagellum entirely reddish yellow; fifth tergite with a pale mark on each side.

Anthidium micrurum (Ckll.). (Fig. 2.)

Male. Length 5.5 mm.

Aspect of *Anthidium braunsi* Fr.; all face below antennæ ochreous, upper part of supraclypeal area light red-brown in middle; mandibles cream, apex dark reddish brown; scape black and pale yellow beneath; first joint of flagellum black-brown, second to fourth light yellowish brown, rest of flagellum reddish brown beneath and deep reddish brown above; mesonotum with short cream stripe on each side above not reaching middle; axillæ entirely cream; scutellum with slightly interrupted ochreous stripe; mesonotum strongly punctured and very shining; scutellum projected as in *Anthidium braunsi* Fr.,

Fig. 2.

Sixth and seventh tergites of *Anthidium micrurum* (Ckll.), ♂.

and slightly emarginated in middle; thorax with very sparse white hairs above; anterior and middle femora light yellowish red, with pale yellow stripe beneath; hind femora black except the yellowish-red apex; anterior tibiæ red, with pale yellow stripe beneath; middle tibiæ yellowish red and mostly pale yellow above; hind tibiæ yellowish red and broadly pale yellow above; anterior tarsi pale yellow; middle and hind tarsi pale yellow, last small joints light yellowish red. First abdominal tergite black, with a transverse and somewhat broad ochreous stripe interrupted on each side of middle by black, apical margin brownish yellow; second tergite black, with a transverse and broad ochreous stripe notched on each side of middle by black, apical margin pale; third tergite with basal half black, rest of disk ochreous, with a transverse linear black-brown stripe above the apical margin, rest of tergites mostly ochreous; a transverse linear stripe above apical margin of fourth tergite and the apical margin of fifth, light yellowish red; sixth tergite with apical margin entire and a little above it irregularly and transversely subcrenulated and very slightly in middle; seventh tergite short, apical margin bilobed and roundly emarginated between, the lobes short, narrow and obtuse in the apex (fig. 2).

SOUTHERN RHODESIA : Gwaai, 2 ♂♂, 16. i. 27, in the National Museum of Southern Rhodesia and in my coll. ; Sawmills, 1 ♂, 22. xii. 28, in my coll. One of the *males* from Gwaai has the occipital stripe broadly interrupted in middle ; apical margin of fourth tergite nearly black-brown.

Anthidium micrurum (Ckll.) was originally described by Cockerell (Ann. & Mag. Nat. Hist. (10) p. 348, 1935) as a variety of *Anthidium braunsi* Fr., but it is a distinct species. *Anthidium braunsi* and *Anthidium micrurum* are closely related, and are separated by the form of the sixth and seventh tergites (Ann. & Mag. Nat. Hist. (10) p. 38, fig. 2, 1936) and the form of the abdominal sternites. *Anthidium braunsi* has the mesonotum strongly and densely punctured, moderately shining, abdominal sternites very shining, with almost minute punctation, without pilosity except the sides ; fifth sternite transversely and somewhat concave in the middle. *Anthidium micrurum* has the mesonotum strongly and sparsely punctured, very shining, abdominal sternites hardly shining, punctured, with short greyish-white hairs ; fifth sternite short and plain.

Anthidium aquifilum Strand, ♂ n.

Male. Length 13 mm. (abdomen end bent).

Black ; clypeus convex, broader than long, densely punctured, dull, lower margin obtusely crenulated ; mandibles tridentate, dull yellow, apex black-brown ; clypeus lateral face marks (filling space between clypeus supraclypeal area and eyes) reaching level of insertion of antennæ, lower part and sides of supraclypeal area, a broad entire occipital stripe, all dull yellow ; scape black, somewhat short, dull yellow in front ; flagellum dark brown and brown in front ; second antennal joint short, sufficiently shorter than third ; antennal joints 3 to 5 equally long ; vertex and occiput with short and somewhat dense fulvous hairs, cheeks with white hairs, a somewhat broad longitudinal furrow between clypeus supraclypeal area and inner orbits. Thorax black ; mesonotum somewhat strongly punctured and dull ; scutellum slightly projected, rounded at sides and emarginated in middle ; pronotum with a dull yellow mark on each side ; mesonotum with a broad L-shaped dull yellow stripe on each side above ; apical margin of scutellum

broadly dull yellow and interrupted by black in middle ; axillæ mostly dull yellow ; tubercles dull, small, rounded, disk plain, not erected in front ; tegulæ dull yellow in front, disk yellowish red behind ; anterior wings slightly clouded, upper half of marginal cell and apical margin clouded ; second recurrent nervure slightly out of second transverse cubital nervure ; nervures and stigma brown ; thorax with somewhat dense and short bright fulvous hairs above and with dense light fulvous hairs at sides ; femora black ; tibiæ black beneath ; anterior and middle tibiæ pale yellow, with dark black-brown marks above ; hind tibiæ pale yellow with dark broad median longitudinal mark above ; basitarsi pale yellow ; small tarsal joints brown ; claws dull yellow, apex brown ; spurs yellowish ; anterior basitarsi very short ; median and hind tibiæ broad ; pulvilli present, but somewhat small ; legs with yellow-white hairs above ; hind basitarsi densely covered with dense bright fulvous hairs on inner side. Abdomen dull yellow, base of first tergite and that of second and third very narrowly black (more in middle) ; apical margins of tergites 1 to 5 nearly brownish yellow ; first tergite on each side of middle with a short and brown line on middle of disk ; tergites 2 to 5 with a basal lateral small brown mark and a short transverse brown line on each side of middle ; apical margin of sixth tergite narrowly dull yellow and roundly emarginated in middle ; seventh tergite hidden below the sixth tergite, nearly entire and black ; first sternite very large, with long and dense hairs on apical margin ; abdomen with short somewhat dense bright yellow-brown hairs above.

Female. Length 13.5 mm.

Head entirely black ; mandibles black, broad, tridentate (left one) and quadridentate (right), dentition obtuse ; clypeus convex, lower margin with five rounded denticles ; scape black ; occiput with broad entire dull yellow stripe ; front, clypeus, vertex and occiput with short bright fulvous hairs ; cheeks with very short light golden hairs above. Thorax as in the *male* ; legs black ; tibiæ with basal pale yellow mark above. Abdomen as in the *male* ; apical margin of tergites 1 to 4 yellow-brown, that of fifth black ; ventral scopa fulvous.

S.W. AFRICA : Otjinbumba, Kunene R., 1 ♂ (*allotype*), March 1923 ; Onolonga, 1 ♀, Feb. 1923 ; both in the South African Museum.

XVII.—*A New Species of Odonata from Ecuador.*

By Flying-Officer D. E. KIMMINS.

THE following description was drawn up some time ago, during the course of my work on the National Collections, and was intended to form part of a short paper of miscellaneous new species of Odonata in the McLachlan Collection. More urgent matters, unconnected with entomology, have intervened, and since the specimens concerned are now labelled in the National Collection, this description is published to validate the MS. name.

Telagrion prothoracicum, sp. n.

Telagrion prothoracicum Selys, MS. name, McLachlan Collection.

♂. Occiput light yellowish brown. Postocular spots large, blue, bordered with brown along the posterior margin. Labrum, post-clypeus and genæ greenish or yellowish, ante-clypeus, frons and vertex yellowish to brownish, inner margin of each ocellus dark brown. Antennæ dark brown.

Prothorax moderately broad, sides gently rounded. Posterior lobe only slightly elevated, from above with a subquadrate projection at its centre, margins on each side delicately and irregularly sinuate. The central portion is shallowly concave, the sides roundly excavate, apical angles rounded with a wide feeble excision between them.

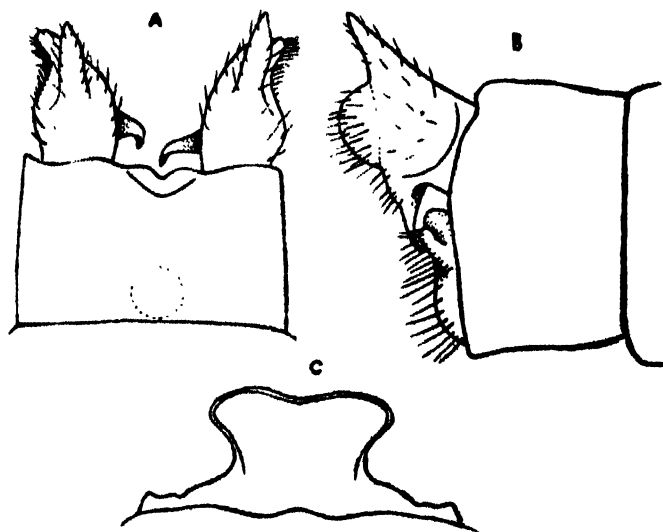
Synthorax small, bluish or bluish green with reddish-brown markings; a median dorsal stripe, about as wide as the ante-humeral bluish band and a narrow humeral stripe over the humeral suture. Sides mainly pale bluish, faintly marked with brownish at the upper end of the second lateral suture. Legs yellowish brown, tibiae slightly darker, shading to blackish brown at apices, which colour continues over the tarsi. Five to eight strong black spines in the outer row on posterior tibia.

Abdomen long and slender. First to fifth segments orange yellow, second to fifth narrowly margined with blackish apically. Sixth segment more or less suffused with blackish brown, seventh black, eighth bluish with a narrow lateral black band in the basal three-fourths, ninth blue, tenth black above, with a small round spot in centre of basal margin, ventral half bluish or yellowish. Superior appendages mainly black, apart from the brownish apical lobe, inferiors yellowish brown, less than

half as long as superiors. Superior appendages with the upper margin produced in a strong acute spine directed tailward; the apical margin forms a rounded hairy lobe and the lower, inner angle is produced downwards and inwards in a slightly curved spine. Inferiors broad in posterior view, upper outer angle forming a short hairy finger.

Wings faintly smoky hyaline. Pterostigma pale brownish, about as long as the underlying cell, rhomboid. Cubital cross-vein midway between first and second antenodals. Anal bridge a little proximal from the cubital

Fig. 1



Telagrion prothoracicum, sp. n. ♂.

A. anal appendages from above; B. the same from the side;
C. posterior lobe of prothorax from above.

cross-vein. Three cells in the discoidal field before the nodus. Post-nodals, fifteen in anterior and thirteen in posterior wing.

Length of abdomen 46 mm.; of hind wing 25 mm.

ECUADOR, Intaj, four males from the McLachlan collection, now in the British Museum (Nat. Hist.). Holotype bearing Selys' MS. label, "*Telagrion prothoracicum* Selys, n. sp., ♂ Ecuador."

In form of the anal appendages this species resembles *T. quadricolor* Ris (Peru), but the apical spine of the superior appendages is much longer and the inferior appendages are less prominent. The posterior lobe of the prothorax resembles more that of *T. oreas* Ris, also from Peru, but the latter lacks the upper apical spine of the superior appendages and has much longer inferior appendages.

XVIII.—*Helminths from the American Cotton-rat* (*Sigmodon hispidus*). By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

THROUGH the kindness of Dr. C. H. Andrewes, F.R.S., and Dr. F. Hawking, of the National Institute for Medical Research, the bodies of a number of wild-caught cotton-rats (*Sigmodon hispidus*) from the southern United States of America were recently received for examination. The following is a list of the helminths recovered from them :—

Nematodes.

- Litomosoides carinii* (Travassos, 1920).
- Physaloptera* ? *hispiculata* Vaz and Pereira, 1935.
- Longistriata adunca* Chandler, 1932.
- Trichostrongylus sigmodontis*, sp. n.
- Strongyloides* sp.

Cestodes.

- Schizotænia sigmodontis* Chandler and Suttles, 1922.
- Raillietina* (*R.*) *bakeri* Chandler, 1942.
- Tænia teniæformis* (Batsch, 1786), larval form (= *Cysticercus fasciolaris* Rud., 1808).

With the exception of *Raillietina bakeri* and the *Trichostrongylus*, all these worms have been previously recorded from this host. Another cestode, *Hymenolepis diminuta* (Rud., 1819), and three other Nematodes, *Protospirura ascaroidea* Hall, 1916, *Physaloptera muris-brasiliensis* Diesing, 1861, and *Monodontus floridanus* McIntosh, 1935, have been recorded from *Sigmodon*, but were not met with in the present series.

Litomosoides carinii (Travassos, 1920*).

. For this Filariid the nomenclature and synonymy proposed by Vaz (1934) are provisionally adopted, though it appears to the writer a little uncertain whether the species *carinii* Travassos, *patersoni* (Mazza, 1928), and *sigmodontis* Chandler, 1931, are really identical, as they were all originally recorded from different hosts.

The adult worms occurred in many of the rats, and were found chiefly in the pleural cavity (mostly on the left side), but occasionally also in the abdominal cavity. Microfilariae were also demonstrated in the blood of the hosts. The adults agree better with the description of "*Vestioletolepta*" *patersoni* by Vogel and Gabaldon (1932) (from *Rattus norvegicus*) than with that of "*Filaria*" *carinii* by Travassos or with those of *L. sigmodontis* by Chandler (1931) and "*Micropleura*" *sigmodoni* by Ocho-terena and Caballero (1932).

Physaloptera ? *bispiculata* Vaz and Pereira, 1935.

Two males and one female of a species of *Physaloptera* occurred in the stomach of one rat. *P. bispiculata*, with the description of which these specimens agree fairly well, was originally recorded from *Nectomys squamipes* in Brazil, but has been recorded from *Sigmodon hispidus* and other North American hosts by Morgan (1941).

Longistriata adunca Chandler, 1932.

This little worm, originally recorded from the same host in Texas, was abundant in the washings from the small intestines of the rats, and probably occurred in the majority of those dissected.

Trichostrongylus sigmodontis, sp. n.
(Figs. 1 & 2.)

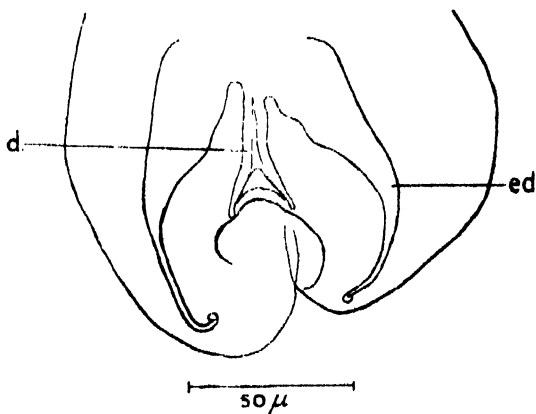
A few specimens of a species of *Trichostrongylus* occurred among washings from the small intestines of at least two of the rats. The males measure 3.75-4 mm. in length, and their maximum thickness (just in front of the bursa) is 0.09-0.12 mm. The females measure 4.5-4.9 mm. and 0.07-0.085 mm. in length and maximum

* The date of the publication in which Travassos' description appears is usually quoted as 1919, but from internal evidence does not seem to have been earlier than April 1920.

thickness respectively. In both sexes the diameter of the head-end, at the level of the papillæ, is about $8-9\mu$, and the length of the œsophagus varies from about 0.47 to 0.75 mm. The cuticle near the anterior extremity is sometimes inflated for a varying distance, but this appears to be an artifact, as it is not a constant character.

The bursa of the male was, in all specimens, tightly rolled inwards and could not be opened out. The general

Fig. 1.



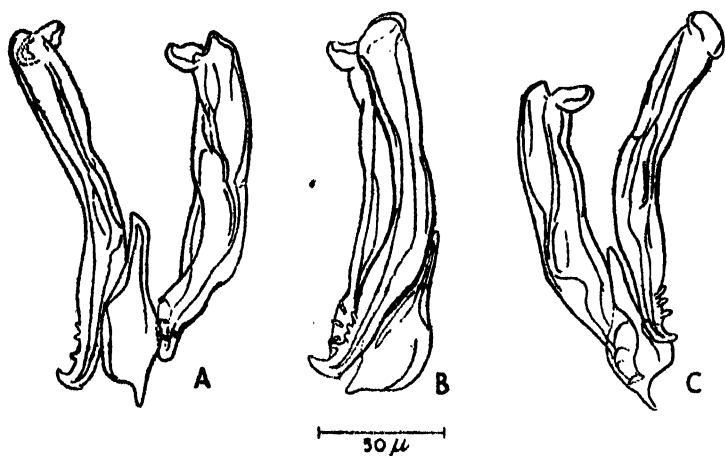
Trichostrongylus sigmoidontis.

Bursa of male: dorsal view, showing only the dorsal ray (*d*) and the externo-dorsal rays (*ed*).

arrangement and proportions of the rays appear, however, to be quite typical of the genus, except that the dorsal ray (fig. 1. *d*) originates asymmetrically from the base of the right externo-dorsal ray, and that the terminations of its two branches appear to be simple. Even under a high magnification the usual double terminations could not be made out, but, as the ray is so small and the preservation of the specimens somewhat imperfect, it is possible that they may be present. The spicules (fig. 2) are unequal in length, the left measuring overall 0.134-0.15 mm. and the right 0.126-0.14 mm. The proportion between the lengths of the spicules varies, so that the longest right spicule does not necessarily occur with the

longest left spicule. The left spicule terminates in a pronounced ventral hook, having a very slight suggestion of a dorsal spur. Anteriorly to this hook, and on the ventral surface of the spicule, there are three (occasionally four) transverse ridges which, in profile, appear as prominent teeth. The right spicule ends in a small button-like structure (fig. 2, C), but is without the hook. It also has transverse ridges (usually three), but these are less prominent than those of the left spicule. The gubernaculum measures about 0.06-0.08 mm. in length, and consists of a broadly-expanded body with narrower

Fig. 2.



Trichostrongylus nigmodontia.

Spicules and gubernaculum in three specimens.
A, dorsal view; B, lateral view; C, ventral view.

anterior and posterior prolongations, of which the former is considerably the longer.

The characters of the female show no departures from those typical of the genus. The tail is conical and slightly curved ventrally, and measures 0.075-0.08 mm. in length. The vulva is situated about 0.6-0.65 mm. from the anus. The combined length of the muscular portions of the ovejectors is about 0.31-0.37 mm. The few female specimens available are apparently young, and contain very few fully-formed eggs. The largest egg seen *in utero* measures about 0.064 × 0.044 mm.

Of the species of *Trichostrongylus* already known to occur in rodents, the present form approaches very closely to *T. calcaratus* Ransom, 1911, and to *T. ransomi* Dikmans, 1937, both from rabbits (*Sylvilagus* spp.) in North America. The spicules of *T. calcaratus* are very similar in shape to those of the present species, but considerably longer. Ransom (1911) gives their length as 175–190 μ , while Nagaty (1932), who has examined co-type material, states that the left spicule measures 176–184 μ and the right 162–180 μ . According to both authors, the ventral surface of the right spicule is without the projections present on the left spicule. The dorsal ray of the bursa, as in the present species, arises from the base of the right externo-dorsal ray. This peculiarity does not, apparently, occur in *T. ransomi*, according to Dikmans' figure, but here again the terminations of the ray appear to be simple. In *T. ransomi* the spicules are said to be equal and similar, though they are figured as being distinctly unequal. In the figure, both spicules appear to be hooked distally, and both appear to have ventral ridges. The tail, in the female of *T. ransomi*, is considerably shorter than in the present specimens, as is also the distance from vulva to anus. Altogether, however, there are so many resemblances between *T. sigmodontis* and *T. ransomi* that it seems possible that they may ultimately prove to be identical.

Strongyloides sp.

A few specimens of the parasitic female of a species of *Strongyloides* were found among the pooled washings from the small intestines of several rats. In view of their rather poor condition, and of the difficulty of identifying species of *Strongyloides* when only the parasitic stage is known, specific determination has not been attempted. It may be noted, however, as a feature of possible specific importance, that in several of the specimens the anterior extremity was more or less sharply bent, sometimes forming a definite hook.

Schizotænia sigmodontis Chandler and Suttles, 1922.

This tapeworm, originally recorded from the East Texas subspecies of the cotton-rat, occurred in small numbers in several of the animals.

Raillietina (*Raillietina*) *bakeri* Chandler, 1942.

A species of *Raillietina* was found to be fairly common in the small intestines of the cotton-rats. It is provisionally determined as *R. (R.) bakeri*, which was originally recorded from a squirrel (*Sciurus niger rufiventer*) in Texas, and has not, so far as the writer is aware, been recorded from *Sigmodon*. *R. bakeri* appears to be the only species of the subgenus *Raillietina* yet known in North American rodents.

The present specimens agree fairly well with Chandler's (1942) description of this species, but show some slight variations, possibly connected with their occurrence in a different host. The rostellar hooks in three specimens were found to number 88, 96 and 97 respectively, whereas Chandler found "about 66." The length of the hooks is about 25-30 μ , as against the 20-22 μ given by Chandler. There are 15 or more rows of spines on the suckers. Chandler was only able to state that there were "at least two" rows, but most of the spines had evidently been lost in his material. The diameter of the rostellum is about 100 μ . Chandler says "diameter across top of crown of hooks 65 to 70 μ ."

Tænia tæniiformis (Batsch, 1786).

In one animal three cysticerci, probably of this species, were found embedded in the substance of the liver. Two of the cysts, when extracted, were almost spherical and measured about 4 mm. in diameter. The "neck" or invagination-canal had not yet begun to elongate or evaginate, and there was, of course, no strobila. The hooks were as yet imperfectly formed, showing different stages of development in the two specimens. In each case 36 hooks were counted. The "strobilocercous" of *T. tæniiformis* has been recorded from *Sigmodon hispidus* by Hawkins (1942). The rat in which it was found, though caught wild in South Carolina, had, like the present animal, been kept for some time in a laboratory, and it seems possible that in each case the infection (which, in the present instance, was evidently recent) had been acquired in captivity.

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XIX.—On the Species of the Polyclad Genus *Paraplanocera*.

By STEPHEN PRUDHOE, Department of Zoology, British Museum (Natural History).

THE genus *Paraplanocera* was erected by Laidlaw in 1903 for the reception of *Planocera langii* Laidlaw, 1902. To it have since been assigned *P. rotumanensis* Laidlaw, 1903, *P. aurora* Laidlaw, 1903, *P. discus* (Willey, 1897)*.

* Jacobowa (1906) redescribed Willey's type-material of *Planocera discus*, and renamed the species *Paraplanocera laidlawi*. The changing of the specific name appears to have been unnecessary, and is therefore contrary to the International Rules of Zoological Nomenclature, as has already been pointed out by Bock (1913).

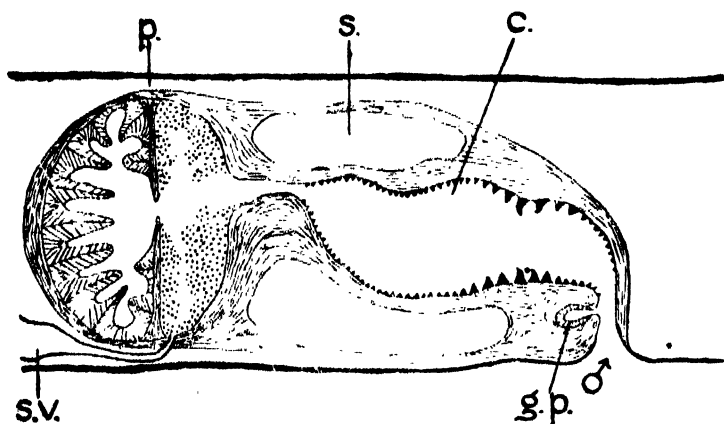
P. misakiensis Yeri and Kaburaki, 1918, *P. marginata* Meyer, 1922, *P. oligoglena* (Schmarda, 1859) and *P. rubrifasciata* Kato, 1937.

Kato (1936) separated the species of this genus into two groups, characterized by the presence or absence of a pair of "glandular pockets" opening into the male antrum. In the latter group Kato placed *P. langii*, *P. rotumanensis* and *P. aurora*, but expressed the opinion that Laidlaw had probably overlooked glandular pockets in these species. According to Laidlaw (1903^u), the male antrum of *P. rotumanensis* is lined with a secretory epithelium. This is unusual, since the antrum of most polyclads is apparently lined with a ciliated epithelium. Thus Laidlaw's observation may suggest that in his material the openings of the pockets were considerably widened, making the pockets themselves appear indistinct. As to this point, it is perhaps worthy of mention that in a specimen of *P. marginata* seen by the present writer the openings are so wide that the pockets appear simply as shallow depressions in the male antrum. The British Museum (Natural History) possesses several specimens labelled "*Paraplanocera rotumanensis*, identified by F. F. Laidlaw," from an unnamed locality. In all these specimens glandular pockets are to be seen. It seems, therefore, not unreasonable to assume that Laidlaw did not recognise these pocket-like structures in any of the three species he has described, and that a pair of such structures, lined with a glandular epithelium and opening into the male antrum, is a generic character.

The Museum possesses also two specimens of a polyclad collected between high and low water-marks on the sand-flats of Bamburi, near Mombasa, Kenya. These specimens seem to agree closely with the original description of *Paraplanocera marginata* Meyer from the Red Sea, but there is a rather important difference in the arrangement of the spines lining the cirrus-cavity. After stating that the cirrus-cavity of *P. marginata* is provided with spines of different sizes, Meyer says, "Ungèfähr in der Mitte befinden sich zwei ziemlich grosse Stacheln, welche an diejenigen bei *Paraplanocera rotumanensis* Laidlaw erinnern." The two spines, or, as Laidlaw describes them, "large folds . . . coated with a thin layer of chitin," found in the cirrus-cavity of *P. rotumanensis*, are enormous

in comparison with the other cirrus-spines, which increase very gradually in size as they approach the male antrum, as in *P. oligoglana* (fig. 2). Meyer has given two figures showing the spines in the cirrus-cavity of *P. marginata*, but in neither figure do there appear to be any spines so dissimilar in size as those found in Laidlaw's form. In fact, the figures show the spines at a point beyond the middle of the cirrus-cavity to increase markedly in size, and then to decrease as the male antrum is approached. This arrangement is comparable with that found in the present specimens (see fig. 1). Consequently,

Fig. 1.



Paraplanocera marginata.

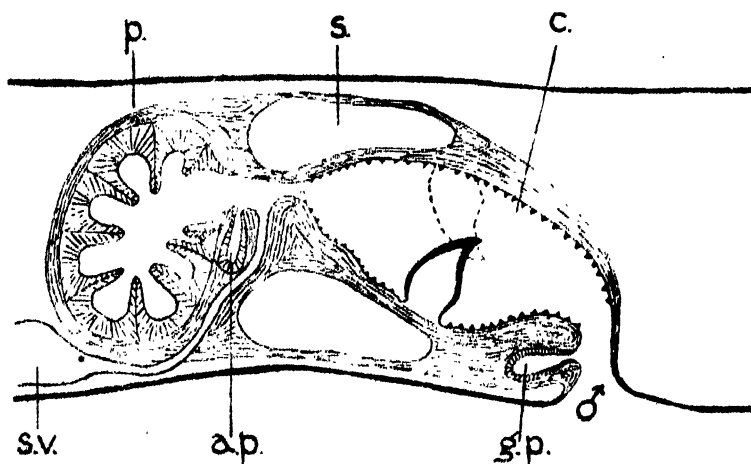
Sagittal section of male copulatory apparatus (diagrammatic). c, cirrus-cavity; g.p., "glandular pocket"; p., prostatic organ; s., intermuscular space surrounding cirrus-cavity; s.v., portion of seminal vesicle.

it seems possible that Meyer was mistaken in stating that the cirrus-cavity of *P. marginata* possesses two large spines similar to those described by Laidlaw in *P. rotumanensis*, and accordingly the writer's material is thought to belong to Meyer's species.

A comparison of the species of *Paraplanocera* shows that, with the exception of *P. aurora*, they may be separated into two groups:—(1) in which the cirrus-cavity is lined with numerous spines, which are com-

paratively large near the male antrum, while the canals from the seminal vesicles open into the ventral wall of the prostatic organ (see fig. 1); and (2) in which the cirrus-cavity is lined with numerous small spines and possesses a pair of very large projections covered with a layer of brownish hyaline substance, while the canals from the seminal vesicles open into the prostatic canal only just before it enters the cirrus (see fig. 2). *P. marginata* and *P. rubrifasciata* may be referred to the first group, and *P. langii*, *P. rotumanensis*, *P. discus*, *P. misakiensis* and *P. oligoglana* to the second.

Fig. 2.

*Paraplancera oligoglana*.

Sagittal section of male copulatory apparatus (diagrammatic).
a.p., accessory prostatic vesicle; *c.*, cirrus-cavity; *g.p.*, "glandular pocket"; *p.*, prostatic organ; *s.*, intermuscular space surrounding cirrus-cavity; *s.v.*, portion of seminal vesicle.

With regard to the species of the first group, the writer's material of *P. marginata* Meyer agrees very well with the description of *P. rubrifasciata* Kato, from Japan. In the former species, however, both in the writer's material and in that of Meyer, there are from two to nine eye-spots lying immediately beneath the apical surface of each tentacle, while Kato does not mention the presence of

eye-spots in this situation in the latter species. Although this character might be considered sufficiently distinctive to separate the two species, a large series of specimens, both from East Africa and Japan, would be required to establish it as a specific criterion. Consequently, as the two species appear to be otherwise indistinguishable, it is thought reasonable to regard them as identical.

Concerning the species of the second group, Kato (1936) has given a very full redescription of *P. misakiensis*, and suggests that this species is probably synonymous with *P. discus* and *P. marginata*, and that *P. langii*, *P. rotumanensis* and *P. aurora* are also identical, although later (1937) he appears to regard most of these species as distinct, for he refers to them individually. Laidlaw (1903) distinguishes *P. rotumanensis* from *P. langii* by the arrangement of the eye-spots, and by the presence of dorsal pigment-containing gut-diverticula. These differences, however, hardly justify specific distinction, as the former character is variable, and Kato has found that the latter may or may not be present in *P. misakiensis*. According to Jacubowa (1906), *P. laidlawi* (i. e. *discus*) may be distinguished from *P. langii* and *P. rotumanensis* by the presence of a pair of "accessory glands" opening into the male antrum, by the greater extent of the vagina anteriorly, and by the presence of only one large "chitinous" projection in the cirrus-cavity, although it is further stated by Jacubowa that two large projections were seen in one specimen. The probability of accessory glands or glandular pockets being present in *P. langii* and *P. rotumanensis* has been discussed above, and it appears, from several specimens of *P. oligoglana* examined by the present writer, that there is a great deal of variation in both the length and shape of the vagina. Thus the characters suggested by Jacubowa for distinguishing *P. discus* from *P. langii* and *P. rotumanensis* seem to have no specific importance.

The posterior wall of the prostatic vesicle in *P. oligoglana* and *P. misakiensis* is apparently differentiated into two small pyriform vesicles which open into the prostatic canal. No mention has been found in the descriptions of *P. langii*, *P. rotumanensis* and *P. discus* of the presence of these accessory prostatic vesicles, but they are to be seen in the specimens identified by Laidlaw as *P. rotuman*

ensis. The accessory vesicles of the prostatic organ are sometimes difficult to make out, especially in poorly-preserved material, where the muscular wall separating them from the main vesicle may be broken down. It seems probable that these two structures were overlooked in *P. langii* and *P. discus*. Stummer-Traunfels (1933) possibly holds a similar view in respect of the latter species, because in his redescription of *P. oligoglana* he appears to be the first writer to record the presence of accessory prostatic vesicles in *Paraplanocera*, and at the same time regards *P. discus* as a synonym of *P. oligoglana*.

The coloration of the dorsal surface of the body might be considered to be of specific importance, but it is apparently so variable in *P. discus* and *P. misakiensis* that varieties of both species appear to be alike in this respect. The variety and density of pigmentation is, no doubt, influenced by physical conditions, since some turbellarians exhibit a great diversity of colour and markings within a single species. Furthermore, in preserved specimens, more especially those preserved in alcohol for a long period, the pigment may be entirely lost. The identification of a species by this means is therefore impracticable.

In view of the above conclusions on alleged specific differences, it appears that the five species belonging to the second group are indistinguishable, and therefore synonymous.

It remains to consider *P. aurora* Laidlaw. According to Laidlaw's (1903 *b*) description of this species, the arrangement of the spines lining the cirrus-cavity corresponds with that found in the first group, while the canals from the seminal vesicles unite with the prostatic canal, as in the second. These features appear to be sufficient to differentiate *P. aurora* from other species of the genus, but as Kato (1936) seems to be of the opinion that this species is probably identical with *P. langii* and *P. rotumanensis*, it is perhaps necessary to re-examine the type-specimen of *P. aurora* to establish the accuracy, or otherwise, of Laidlaw's description. In view of the uncertainty connected with *P. aurora*, the species is here accepted provisionally as valid.

To sum up what has been said, it is suggested that the species of *Paraplanocera* and their synonymies are as follows :—

1. *Paraplanocera oligoglena* (Schmarda, 1859)
Stummer-Traunfels, 1933.

Synonymy :—

Stylochnus oligoglenus Schmarda, 1859. Neue Wirbellose Thiere [&c.], i. Hälte 1, p. 34.

Stylochnus amphibolus Schmarda, 1859. *Ibid.* p. 34.

Stylochnus oligochlamus Grube, 1868. Jahres-Bericht d. Schles. Ges., Breslau, xlv, p. 46.

Planocera oligoglena Lang, 1884. Fauna u. Flora d. Golfes v. Neapel, xi, p. 444.

Planocera amphibola Lang, 1884. *Ibid.* p. 444.

Planocera discus Willey, 1897. Quart. J. Microsc. Sci. xxxix, p. 155.

Planocera langii Laidlaw, 1902. Fauna & Geogr. Maldive & Laccadive Archipel, i, p. 286.

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Paraplanocera rotumanensis Laidlaw, 1903. *Ibid.* p. 4.

Paraplanocera laidlawi Jacobowa, 1906. Jena. Zeitschr. Naturw. xli, p. 115.

Paraplanocera langi Bock, 1913. Zool. Bidrag f. Uppsala, ii p. 246.

Paraplanocera discus Bock, 1913. *Ibid.* p. 246.

Paraplanocera misakiensis Yeri & Kaburaki, 1918. Annot. Zool. Japon. ix, p. 432.

Type-locality : south coast of Ceylon, Indian Ocean.

Other localities : Indian Ocean (Ceylon, Minikoi Atoll and Christmas I.*); Pacific Ocean (Japan, New Britain, New Caledonia, Rotuma, Samoa and Tahiti*).

2. *Paraplanocera aurora* Laidlaw, 1903.

Type-locality : Zanzibar, British East Africa, Indian Ocean.

Other localities : Indian Ocean (Ceylon).

3. *Paraplanocera marginata* Meyer, 1922.

Synonym :—

Paraplanocera rubrifasciata Kato, 1937. Jap. J. Zool. vii, p. 360.

Type-locality : Red Sea, Indian Ocean.

Other localities : Indian Ocean (Kenya*); Pacific Ocean (Japan).

* New records.

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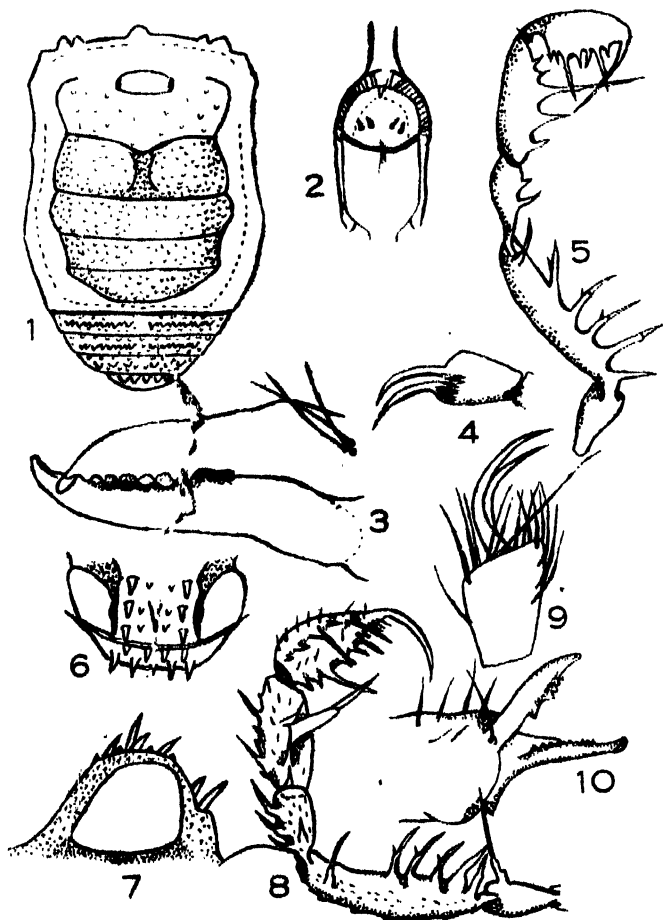
XX.--*New Opilionids (Laniatores) from Indian Caves.*
By F. A. TURK, Ph.D., F.R.E.S., F.Z.S.

EARLY in 1944 I received seven tubes of Opilionids from Brigadier E. A. Glennie, D.S.O., of the Indian Geodetic Survey, besides other Arachnids and Diplopods, all taken from Indian caves. The Diplopods I have dealt with in a former paper (Turk, 1945), and it is most interesting to find that the present collection of Opilionids supports very remarkably indeed the zoogeographical results of that paper.

It is very unfortunate that a great deal of the material on which the present studies are based reached me in a very poor state of preservation. It was not possible to make a specific or even generic diagnosis of several specimens, and practically all had suffered in some way or another. Certain general statements about the collection are, however, possible. Every specimen belonged to the suborder Laniatores, and this is significant in view of the fact that among a small collection of epigean forms taken by my friend, Capt. H. J. Larwood, M.Sc., from the same district and sent to me at the same time, every specimen was referable to the suborder Palpatores, family Phalangiidae, subfamily Gagrellinae.

Amongst the specimens too damaged to identify with any certainty were examples referable to the subfamily

Figs. 1-10.



1. *Indusidama moila* Turk: body, dorsal aspect; 2. genital operculum of female; 3. chela of male; 4. claws of the third legs; 5. palpus.
6. *Bundelkhandia cavernicola* Turk: ocular tubercle, dorsal aspect; 7. ocular tubercle, lateral aspect; 8. palpus; 9. claws of third leg; 10. chela.

Hypoxestinae of the Assamiidae and one which was probably a species of Epidanidae. With the possible

exception of this last it will be seen that all the forms found in the caves were members of the family Assamiidæ.

For help with the literature and the making of suitable permanent mounts of the specimens described below—a difficult matter having regard to their fragile nature and poor preservation—I am indebted to my former pupil, Miss S. M. Phillips, F.Z.S.

Subfamily *Sidaminæ* Roewer, 1935.

INDOSIDAMA, gen. nov.

Allied to *Sidama* Pavesi, 1895. The stigmata are hidden under very large teeth. Ocular tubercle smooth and totally unarmed. No median horn on the carapace. Tarsus of first leg with four segments with the end-piece ("Endabschnitt" of Roewer) two-ringed. End-piece of the second tarsus eight-ringed (three-ringed in *Sidama*). Claws of tarsi 3 and 4 simple and without pseudonchium. Segmentation of tarsi otherwise as in *Sidama*. The posterior part of the abdominal scutum with very small and the free tergites of the abdomen with quite large teeth arranged in rows. It may be distinguished most easily from the genus *Sidama* by the longitudinal furrow on "Area 1" of the abdominal scutum.

Type-species, *Indosidama moila* mihi.

Indosidama moila, sp. n.

Length 3.5 mm. Width at the broadest part of the abdominal scutum 1.75 mm. Colour light chestnut-brown, the legs lighter and the abdominal scutum changing to a light yellow in the middle. Ocular tubercle placed one-third the length of the cephalothorax from its anterior border. Femur of palp ventrally with a row of five spines and one median apical spine, as in *Sidama maestri* Pavesi. The genital operculum of the female is armed with four fairly stout spines (fig. 2), but that of the male has no especial specific character. The chelæ of the male are rather stouter than those of the female and have a group of three characteristic long hairs on the fixed ramus, as figured in fig. 3. Eyes somewhat reduced in size.

Type-material: 1 male from Moila Swallet, India, May 1943; 1 female from cave at Bodhyar, India (no other data given).

It is perhaps worth noting that the female mentioned above had much of the left ventral and lateral surfaces of the cephalothorax covered with a dense incrustation of a black mould (*Cladosporium* ? sp.), and the palp of the same side considerably reduced and deformed. It would appear that this specimen was alive when taken and the fungus must have been present in the role of a parasite. It is, I believe, unusual for black moulds to appear on any of the terrestrial arthropods except after death when decay has started to take place.

Subfamily **Hasadiinae** Roewer, 1935.

BUNDELKHANDIA, gen. nov.

This genus is closely related to the genus *Argobba* Roewer, 1935 (Roewer writes this *Argrobba* (sic) in his designation of the type species—evidently a printer's error). In addition to possessing the characters of the subfamily it agrees with *Argobba* in having but one median apical spine on the femur of the palp. It differs from this genus in having the scutum and the tergites of the first to third abdominal segments each armed with several rows of small spines. The spines of the palp (fig. 8) are peculiar and characteristic, particularly those on the two distal segments, and are best made out on the figure, but attention may be drawn to the very long and very stout spine set in a ventral row of three other spines on the tibia. The median process on the anterior dorsal edge of the cephalothorax is equally as long as the two flanking ones on either side. The ocular tubercle is characteristically spined with two lateral dorsal rows of spines and a rather longer median one which projects nearly vertically (figs. 6 and 7).

Type-species *Bundelkhandia cavernicola* mihi.

Bundelkhandia cavernicola, sp. n.

Length 4.5 mm. in both male and female. Colour light chestnut-brown. Ocular tubercle placed in the middle of the cephalothorax and of characteristic shape and armature. Basal portion of the femur of the fourth legs bears three outstanding warts, and that of the male is only very little more thickened than the female. The fourth coxa of the male with a fairly large backwardly-

directed blunt process. The chelæ are also characteristic with three prominent teeth on the movable ramus, which bears a single long hair at its base. Eyes in both sexes very large (fig. 7).

Type-material: 1 female, Toad-hole cave, Moila Swallet, June 1943, and 1 male, Moila Swallet, Sept. 1943.

Subfamily *Trionyxellinæ* Roewer, 1912.

Calloristus cavernarum, sp. n.

This genus is a monotypic genus erected by Roewer in 1935 for *C. granipes* Roew., from Madura, in the South Deccan, India. The present species may be easily distinguished from *C. granipes* by the fact that all the spines on the tarsus of the palp are as long as or longer than the terminal one, whereas in *C. granipes* they are all shorter. There are no teeth at all to be seen on the femur of the palp. The form is remarkable for the extremely large chelæ, the fixed ramus of which bears a large outstanding tooth midway between the terminal one and a proximal row of six teeth. Ocular tubercle untoothed. Cephalothorax smooth and unarmed. Warts on the scutum and free tergites much reduced but bearing longish hairs each about two-thirds the antero-posterior width of the tergite.

Type-material: 1 male and 1 female from Moila Swallet, June 1943.

All the above type-material is, temporarily, in my collection.

The most interesting result of the diagnosis of the above forms is that the species here recorded of the subfamilies *Harsadiinæ* and *Sidaminæ* are the first representatives of those subfamilies to be found in India; all the other forms hitherto known are confined to Africa, mostly East Africa and Abyssinia. The *Trionyxellinæ*, too, are confined to South Africa, South Deccan, India, Ceylon and Borneo, and the present species of *Calloristus* marks the furthest extension northwards of the subfamily so far known.

It is remarkable, too, that the African and Indian forms should be so nearly related, considering the immense

period of time which must have elapsed since their dispersal from a common place of origin, but this is really in keeping with the known facts of the great similarity between many of the Laniatores of the New and Old Worlds.

The geographical distribution and relationships of the forms discussed in this present paper make it seem probable that the colonisation of the Indian peninsula was from the south rather than the north, and it is no new thing to find that the representatives at the limits of the territorial range of a genus or larger group are cave-dwelling forms. Thus, there is further evidence to be found here in this group, as in the cave Diplopods of India (Turk, *loc. cit*), for a former land connection between India and Africa, or, at least, that both have had a connection with a common locus of origin for these forms. This whole matter, however, I propose to deal with in more detail in a subsequent paper.

There is little evidence here of any special adaptations to a cave-dwelling life, although the colour of all these specimens is lighter than that of their near relatives and may be attributed, perhaps, to this cause. It is significant that whilst *Indosidama moila* has the eyes somewhat reduced, yet in *Bundelkhandia cavernicola* the eyes are larger than is usual, and in *Calloristus cavernarum* they are similar to the only other known species of the genus, an epigaeic form. Reviewing the characters of these cave-inhabiting forms as a whole the only structural characteristic which they have in common--and that possibly a non-adaptive one--is the tendency either to larger or a greater prolixity of spines on the palp, especially on the tarsus. This increased spiny armature is to be found elsewhere amongst cavernicolous Laniatores.

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XXI.—*Descriptions and Records of Bees.*—CXCV.

By T. D. A. COCKERELL, University of Colorado.

Halictus lamborni, sp. n.

♀.—Length about 7.3 mm., with unusually short abdomen; anterior wing 5.3 mm.; black, robust, remarkable for the very long mouth-parts, although the tongue is very short; the mentum is about 2.5 mm. long, and the mouth can be extended beyond the head more than the length of the latter; the head is broader than long, and very deep posteriorly as seen in lateral view; mandibles red, black at base and apex; antennæ black, scape long, the flagellum thick and remarkably short; face (including clypeus) and front dull, top of head shining; hair of head and thorax white, very scanty; mesonotum dull, scutellum moderately shining, bigibbous; area of metathorax large, dull and rough, not plicate; tegulæ red; wings hyaline, stigma pale brown, narrow, nervures very pale; second submarginal cell broad, receiving recurrent nervure not far from end; third submarginal higher than long; legs black, with the small joints of tarsi red; hind spur with a long finger-like spine, followed by two small lamellæ; abdomen very broad, shining, the first three tergites rather broadly reddish apically; second to fourth tergites with basal bands of white tomentum; venter with much outstanding white hair.

Nyasaland; Lingadzi, near Domira Bay, alt. 1700 ft., March 3, 1915 (*Dr. W. A. Lamborn*).

In some respects this resembles *H. guineacola* Strand, as determined by Friese, but the metathorax is quite different. *H. michælseni* Friese has a rather similar abdomen, but different hind spur.

Halictus (Oxyhalictus) libericus, sp. n.

♂.—Length about 7 mm., anterior wing 5.3; black, moderately robust, the head and thorax with scanty short pale hair; clypeus shining, prominent, nose-like in lateral profile, entirely black, with a median groove; mandibles small and black, malar space not developed; tongue with a very long linear extension; antennæ black, moderately long for a male; mesonotum moderately shining; scutellum small, shining, depressed in middle; area of metathorax shining, with strong plicæ; tegulæ

black, rather large ; wings faintly dusky ; stigma brown, not very dark, second submarginal cell rather broad, receiving recurrent nervure at apical corner ; legs black, with the small joints of tarsi reddish ; abdomen polished, without distinct bands, but wedge-shaped patches of greyish hair at lateral bases of second to fourth tergites ; reddish apical plate rather narrow ; venter polished.

Liberia ; Memeh Town, Aug. 29, 1926 (*J. Bequaert*).

Smaller than *H. ituricus* Ckll. from the Belgian Congo, and with various small differences, but evidently allied.

A female from Ibadan, S. Nigeria, from cotton, 1925 (*O. B. Lean*), is confidently referred to this species. It has exactly the same kind of tongue, and the other characters agree, except for the usual sexual differences. The anterior wing is about 5.6 mm. long. The venter has some long outstanding hair.

Halictus stanleyi, sp. n.

♂.—Length about 9 mm., anterior wing 8 mm ; black, with the labrum and the broad apex of clypeus yellow, antennæ reddened beneath apically, small joints of tarsi, and hind basitarsi at apex, red, hind margins of abdominal tergites very narrowly pallid ; antennæ rather short for a male, flagellum thick ; hair of head and thorax very long, slightly brownish ; mesonotum and scutellum dull ; area of metathorax dull, the metathorax, except the area, with abundant long hair ; tegulæ mainly red ; wings hyaline, faintly dusky ; stigma slender, very dark brown ; second submarginal narrowed above, receiving recurrent nervure far from end ; legs with long hair ; abdomen somewhat narrowed basally, moderately shining, without the ventral characters described for *H. patriciformis* Ckll.

Mt. Ruwenzori, Congo, 0° 30' N., 29° 50' E., alt. 2500 m., May 18, 1914 (*J. Bequaert*). I thought this might possibly be the male of *H. subpatricius* Strand, which has clear fulvous tegulæ, but I believe it is distinct.

The species is named after the explorer who gave the first account of Ruwenzori.

Halictus triflorus, sp. n.

♀.—Length about 7 mm., anterior wing 6 ; black, including mandibles, antennæ and legs, the tarsi rufescent at

end; hair of head and thorax rather thin, slightly brownish; head rather broad, clypeus shining, with a median groove, front dull; mesonotum and scutellum highly polished, the scutellum with a median groove; postscutellum with long hair; area of metathorax large, with a somewhat shining margin, and no distinct plicæ; tegulæ shining very dark brown; wings dusky; stigma dark brown; second submarginal cell broad, receiving recurrent nervure before the end; legs with pale hair, floccus on hind femora large; abdomen broad-fusiform, the first tergite highly polished; the first three tergites (but not the fourth) with linear marginal pale yellow tegumentary bands; no hair-bands.

Mt. Ruwenzori, Congo, 0° 30' N., 29° 50' E., alt. 1400 m., June 5, 1914. (*J. Bequa rt.*) Related to *H. patriciformis* Ckll., which is larger and otherwise different. Among the known Ruwenzori species, it may be compared with *H. ruwenzorensis* Strand, which is larger, and has the legs with black hairs.

Halictus giffardiellus, sp. n.

♂.—Length about 4.5 mm., anterior wing about 3.8; head broad, face and front covered with white hair; margin of clypeus, labrum and mandibles light yellow (sulphur-yellow), the mandibles a little reddened at apex; antennæ extremely long, the flagellum pale red beneath; mesonotum polished, anteriorly with much white hair; scutellum polished; area of metathorax polished; tegulæ small, pale brown; wings hyaline, stigma rather dark brown, nervures pale; second submarginal cell narrow, receiving recurrent nervure near its apical corner; third submarginal cell higher than long; knees, tarsi, and tibiæ at apex very pale yellowish; abdomen polished, with conspicuous bands of white tomentum at bases of second and third tergites.

Sudan; Shendi, on cotton, Nov. 25, 1926 (*W. E. Giffard*). Related to *H. asnicus* Ckll., from Morocco, but distinguished by the yellow mandibles and shining area of metathorax.

Halictus shendicus, sp. n.

♂.—Length about 6 mm., anterior wing 5.5; black, the hair of head and thorax thin and white, long and abundant on front, dense on postscutellum, long on mesopleuræ;

head broad, quadrate, with nearly parallel orbits; clypeus and supraclypeal area polished, without light markings; labrum with a reddish band; mandibles bright chestnut red; antennæ only moderately long for a male, flagellum dusky reddish beneath; vertex polished; mesonotum dull, slightly shining; scutellum with two shining spots; area of metathorax large, dull, with numerous close-set plicæ; tegulæ very dark brown; wings hyaline, stigma dark brown, unusually slender; second submarginal cell large and square; first recurrent nervure meeting intercubitus; third submarginal cell higher than long; legs dark brown with the tarsi pallid, reddish at end; abdomen shining, with conspicuous bands of white tomentum at base of second and third tergites.

Sudan; Shendi, Dec. 30, 1920 (*H. H. King*). I suppose that this is not the male of *H. gibber* Vachal, from Suakim. There is some resemblance to *H. villosulus* Kirby, but the wings are different (as to N. African *H. villosulus*, see *Ann. & Mag. Nat. Hist.*, Jan. 1938, p. 82).

Halictus walikalensis, sp. n.

♂.—Length about 5.5 mm., anterior wing 4.3; head, thorax and abdomen rather dark green, the first tergite of abdomen brilliantly polished; head broad; mandibles red; scape red in front; flagellum black, moderately long; sides of face with pale tomentum; front dull, region of ocelli shining; mesonotum shining, with thin pale hair; scutellum highly polished, not bigibbous; area of metathorax with strong rugæ except at sides; tegulæ small, pale testaceous; wings clear hyaline, stigma large, pale yellowish, nervures practically colourless; second submarginal cell narrow, contracted above, receiving recurrent nervure at apical corner; outer nervures weak; femora, tibiæ and tarsi entirely clear orange; abdomen rather stout with hind margins of first four tergites fulvous; abdomen beyond third tergite covered with yellowish tomentum; the first three tergites are broadly tomentose at sides.

Belgian Congo; Walikale, 1° 25' S., 28° E., Jan. 7, 1915 (*J. Bequaert*). Evidently related to *H. bellulus* Vachal, and perhaps also to *H. magretti* Vachal. It will be recognised by the orange legs. It belongs to the subgenus *Chloroliatus*.

Halictus ruwenzoriellus, sp. n.

♀.—Length 6.3 mm., anterior wing 6 mm.; rather robust, black, including mandibles and legs, flagellum red beneath except at base; head and thorax with dull, slightly brownish hair; head broad; clypeus shining; front dull, with a shining triangular area in front of middle ocellus; mesonotum and scutellum moderately shining, but not polished; area of metathorax dull, not plicate; tegulae small, black; wings dusky; stigma large, very dark brown; second submarginal cell narrowed above, receiving first recurrent nervure a little before end; marginal cell broad; legs with pale hair, hind tibiae and basitarsi densely hairy; abdomen polished, without bands, apex with pale hair; sternites with reddish hind margins; venter with outstanding pale hair.

Mt. Ruwenzori, Congo, 0° 30' N., 29° 50' E., alt. 3000 m., April 15, 1914 (*J. Bequaert*). This may be compared with *H. megadelphus* Ckll., from Tshibinda, but that has the head oval, and the first recurrent nervure meeting intercubitus. There is also some resemblance to *H. allaudi* Vachal.

Halictus ruwenzicus, sp. n.

♀.—Length about 6.3 mm., anterior wing 5.3; black, the shining mesonotum and scutellum distinctly green or greenish, the tegulae very dark brown, the wings dusky, with large dark brown stigma; antennae black, the flagellum faintly brown beneath, scape very long; head broad oval; clypeus very short, shining; mesonotum polished; area of metathorax large, dull, not plicate, with a rounded shining margin; second submarginal cell large, receiving recurrent nervure at its apical corner; legs black, with pale hair; abdomen shining black, without hair-bands, but apex pubescent.

Mt. Ruwenzori, Congo, 0° 30' N., 29° 50' E., alt. 2500 m., May 18, 1914 (*J. Bequaert*). Two specimens. Very close to *H. epichlorus* Ckll., but larger, with darker antennae, mesonotum polished, third submarginal cell on marginal little broader than second, dark stigma, dusky wings. The dark nervures separate it from *H. evanidus* Vachal. The posterior truncation of metathorax is small, and moderately shining.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY

[ELEVENTH SERIES.]

No. 88. APRIL 1945.

XXII. — *Notes on the Jurassic Flora of Yorkshire*, 16–18.
By TOM M. HARRIS, University of Reading.

16. *Baiera furcata* (L. & H.) Braun. (Figs. 1, 2.)

1. Yorkshire specimens.

1837. *Solenites furcatus* Lindley and Hutton, pl. ccix. (Good figures.)
1843. *Baiera furcata* (L. & H.) Braun, p. 21. (Name.)
1869. *Jeanpaulia Lindleyana* Schimper, p. 683. (Name.)
1875. *Solenites furcata* (L. & H.) Phillips, p. 199, Lign. 7. (Poor figure.)
1900. *Baiera Lindleyana* Schimper, Seward, p. 266 in part; pl. ix. fig. 6 only (good leaf); pl. ix. fig. 7 is probably *B. gracilis*, text-fig. 46 is *Czekanowskia microphylla*.
1919. *Baiera Lindleyana* Schimper, Seward in part, p. 49, text-fig. 653 B only. (As Seward, 1900, pl. ix. fig. 6, but re-drawn.)
1929. *Baiera Lindleyana* Schimper, Black, p. 427. (Comparison with *B. scalbiensis*.)
1926. *Baiera furcata* (L. & H.) Florin, p. 107. (Name.)

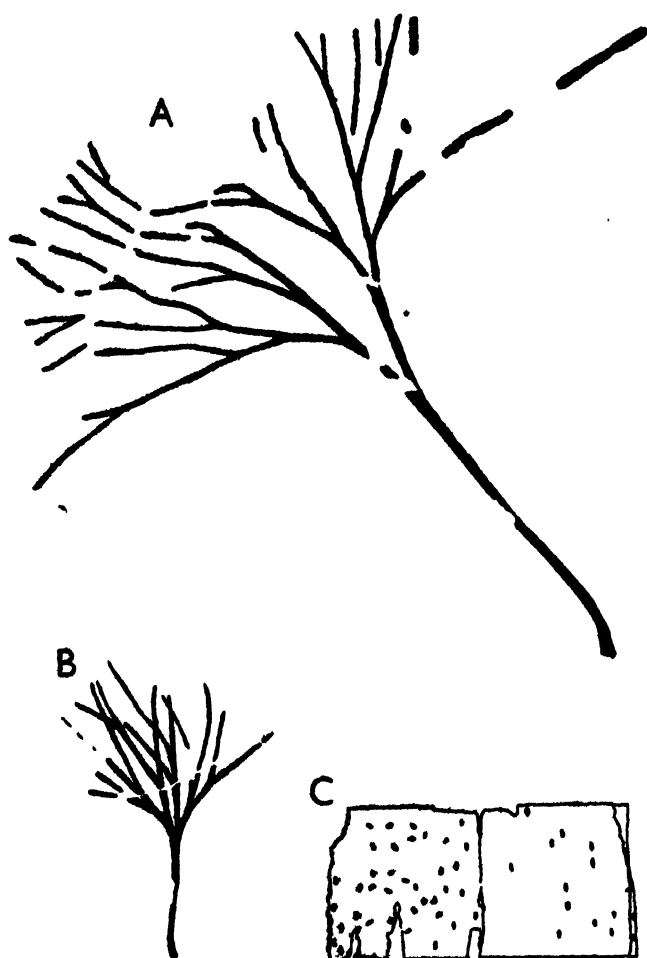
See Seward, 1900, for other references.

2. Specimens from other regions described as *B. Lindleyana*; in no case confirmed by cuticle. Some are certainly distinct.

- 1911a. *Baiera Lindleyana* Schimper, Seward, p. 48, pl. iv. fig. 44. (Chinese Dzungaria.)
1911b. *Baiera Lindleyana* Schimper, Seward, p. 680, pl. v. fig. 105. (Upper Jurassic, Scotland.)
1925. *Baiera Lindleyana* Schimper, Kawasaki, p. 49, pl. xliii. fig. 117b. (Korea.)
1933. *Baiera Lindleyana* Schimper, Sze, p. 29, pl. vii. fig. 8. (China.)
1939. *Baiera Lindleyana* Kawasaki, p. 39, pl. xiii. fig. 54. (Korea.)

Introduction.—The present material consists of two specimens (V. 6475, V. 10376, Mantell Collection) in the Department of Geology of the British Museum and five
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Fig. 1.

*Baiera furcata.*

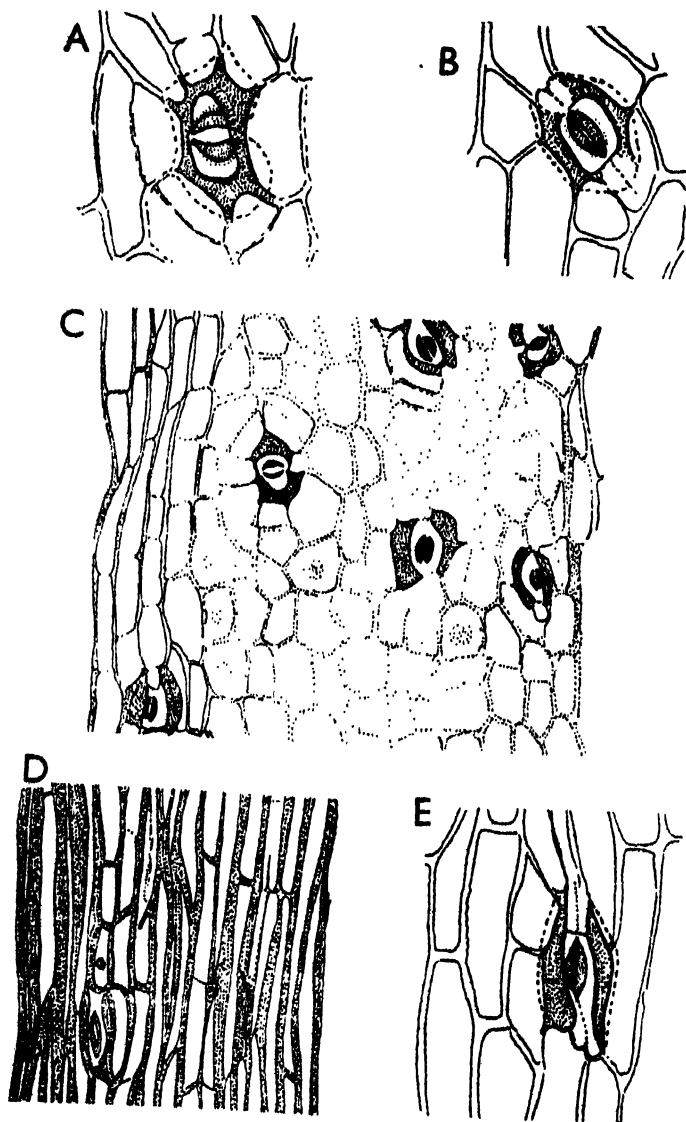
A, V. 6475, all lobe apices are missing, $\times 1$. B, small leaf, York Museum (some lobes damaged), $\times 1$. C, distribution and orientation of stomata in approx. 1 sq. mm. of lamina, lower side left, upper side right, V. 6475, $\times 20$.

in the Yorkshire Museum, York. The only specimen properly localised is one of the York ones which is labelled Haiburn Wyke: the others are in a similar-looking matrix and might be from the same locality. Several are associated with *Baiera gracilis*. The plant bed at Haiburn Wyke is of Lower Estuarine age (part of the Lower Bajocian, Inferior Oolite). The type-specimen of Lindley and Hutton came from Haiburn Wyke.

Nomenclature.—Lindley and Hutton (1837) described some excellent specimens of this leaf as *Solenites furcatus*, and Braun soon after placed the species in *Baiera* with which later writers concurred. Schimper (1869), however, gave it the new name of *B. Lindleyana* because he wished to use the name *furcata* for a different leaf, *i. e.*, Heer's (1865) *Sclerophyll'na furcata*. The name *furcatus* L. & H. being older should have been kept, but in spite of this the names *Baiera Lindleyana* Schimper and *Baiera furcata* (Heer) have come into general use. A new specific name is not, however, needed, because Heer's leaf is placed in a different genus, namely, *Spheno'aiera* Florin. Its correct name is *Sphenobaiera furcata* (Heer) Florin; Florin, 1936, p. 108.

Emended diagnosis.—Lamina up to about 7 cm. long from first fork to apex of the lobes; petiole slender, as long as the lamina; lamina as a whole forming $\frac{1}{3}$ – $\frac{1}{2}$ of a circle, divided by four or five successive dichotomies, angle of each dichotomy about 30°. Lobes of lamina slender, 1.0–1.5 mm. wide near the leaf base, tapering gradually to 0.5 mm. near the apex. Apex of lobe simple, acute. Substance of lamina thick, veins obscure; usually two dark internal strands present in the lower lobes, one in each final branch of the lamina; resin not visible till after maceration, but forming numerous small round or oval masses alongside the veins. Cuticle thick and tough; upper about 4 μ , lower about 2 μ (measured in folds). Upper cuticle showing a small number of scattered stomata, sometimes forming short rows; epidermal cells elongated, lateral walls prominent and thick, surface flat: cells near stomata sometimes shorter and rarely showing a thickened area of the surface; veins scarcely or not at all distinguished.

Lower cuticle showing numerous stomata, scattered or in short longitudinal rows; epidermal cells varying from

*Baiera furcata.*

A, B, typical stomata (lower epidermis), $\times 400$. C, lower epidermis, $\times 200$. D, upper epidermis, $\times 200$. E, stoma orientated longitudinally (lower epidermis), $\times 400$. All from V. 6475.

isodiametric polygons to rectangles three times as long as broad; lateral walls straight, broad but inconspicuous; surface usually flat and finely mottled, sometimes but not often showing an area of very slight thickening in the middle. Position of veins scarcely or not at all distinguished; but surface sometimes showing narrow tracts of elongated cells and fewer stomata possibly marking a vein.

Stomata on upper side mostly longitudinally orientated; stomata on lower side longitudinal, oblique or transverse. Aperture of guard-cells strongly cutinised, sunken at the bottom of a rather wide pit. Margin of pit forming a thick, slightly overhanging rim of cuticle, better developed over the sides of the guard-cells but often continued over their poles to form a complete rim. Pit of longitudinal stomata varied, wide or narrow; pit of oblique or transverse stomata usually wide, often almost circular. Subsidiary cells irregular in size, normally with no papilla. Encircling cells occasional and irregularly developed. Trichomes absent from both under and upper sides.

Discussion.—The present specimens form a very uniform set of leaves, varying only in size: their cuticles proved almost uniform and all show similar resin bodies. One of the largest leaves is that shown in fig. 1 A; all the lobe apices have been broken off at the edge of the rock fragment, but in another similar-looking leaf in the York Museum, the lobes taper gradually without further branching to an acute apex 7.2 cm. from the first dichotomy.

It should be noted that the "veins" described above are merely the dark strands visible by transmitted light in favourable specimens after clearing. They are doubtless vascular strands, but whether they are strictly single vascular units or compound bundles as, for example, in a *Pinus sylvestris* leaf, is indeterminable from this material.

Comparison.—There are very few leaves which can be confused with *B. furcata*. The fragments of *Czekanowskia microphylla*, once included by Seward (1900), were later separated by him (1919): the leaves are quite different when complete enough to show their shape. I think also that the specimen figured by Seward (1900, pl. ix. fig. 7; 1919, fig. 653 A) as a leaf intermediate between this species and *B. gracilis* is merely a battered leaf of *B. gracilis*.

B. scalbiensis Black is rather close but distinguished by having lobes which do not taper to the apex and by the cuticle which, according to Black, clearly shows the veins; moreover, the stomatal pit is narrower and the subsidiary cells usually have conspicuous papillae. The differences in cell-shape and angle of dichotomy of the lobes mentioned by Black (1929, p. 426), however, do not seem to apply to the present material.

None of the leaves determined from regions other than Yorkshire as *B. furcata* L. & H. or *B. lindleyana* Schimper can be accepted without reservation until their cuticles are investigated. One of the Korean leaves (Kawasaki, 1925) agrees in appearance, but the other (1929), which is presumably only a fragment of the lamina, is certainly distinct. Its segments are wider and fork at a smaller angle than in *B. furcata*. Sze's (1933) Chinese specimen is just like the smallest leaf figured here, but there is no evidence of normal-sized leaves associated with it. The fragmentary specimens figured by Seward (1911 *a*, 1911 *b*) are, in my opinion, undeterminable. There is thus no satisfactory evidence that this species has yet been found outside Yorkshire.

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17. *Sphenobaiera pecten*, sp. n.
(Figs. 3, 4.)

Material.—The specimens all occur on a small block included in the Herries Collection, Yorkshire Museum, York. It is unlabelled, but I feel sure it comes from one of the Yorkshire exposures of the Estuarine series, because (1) the whole Herries Collection is of Yorkshire material, (2) it was packed with many other plants labelled and unlabelled, all the others being familiar species in the Yorkshire Estuarine (Lower Oolite). The face of the specimen had been thickly smeared with a water-soluble gum which was successfully removed. The cuticle on the gummed side has been damaged or destroyed, but excellent preparations were made from parts still covered by rock.

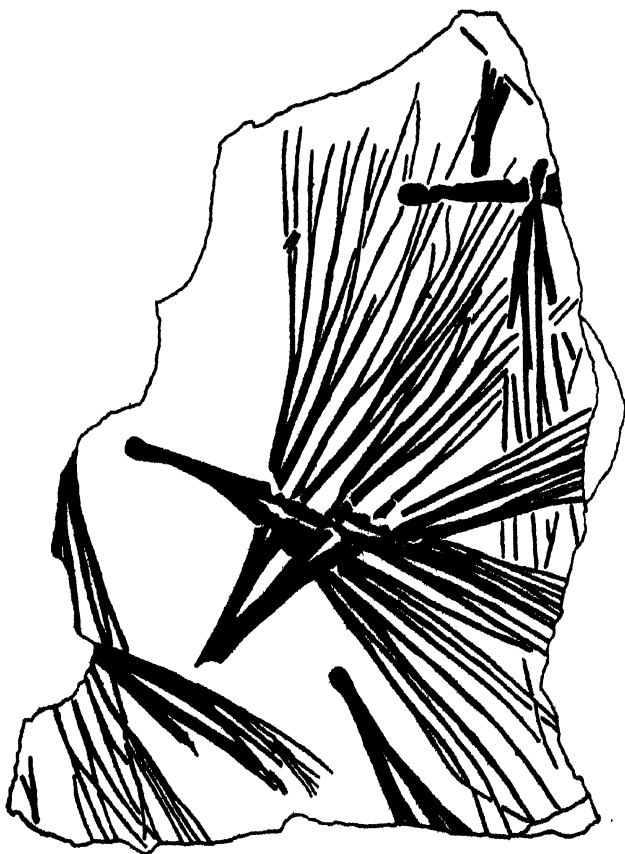
I am indebted to Mr. R. Wagstaffe for lending me the specimen.

Diagnosis.—Leaf as a whole wedge-shaped, up to 10 cm. long, up to 7 cm. wide. Leaf-base rounded, first dichotomy occurring within 2 cm. of the leaf-base and subsequent dichotomies at intervals of 1.5–2 cm., up to six dichotomies occurring in the larger leaves. Lamina 2–3 mm. wide in its lower part, becoming progressively narrower, ultimate segments filiform, about 0.7 mm. wide below, 0.5 mm. wide above, apex acute. Substance of lamina thick. Veins not seen in leaf-base, obscurely shown as 2–4 broad ridges in lower leaf-segments, reduced to a single median strand in ultimate segments. Resin constantly present, but not abundant, forming oval masses about 100 μ long. Cuticle tough and fairly thick (about 3 μ) on both sides. One side (considered to be upper) slightly thicker and showing fewer stomata and no trichomes. Veins marked in lower parts of leaf by tracts of epidermis with few or no stomata on either surface, but not distinguished in upper parts of leaf. Trichomes absent above, rare and mostly confined to veins below. Stomata scattered in stomatal bands, not forming well marked rows, but orientated longitudinally (except in area just below a dichotomy).

Epidermal cells forming longitudinal rows, cells isodiametric to moderately elongated, ends often oblique. Cell-outlines broad and prominent, straight and usually entire. Cell-surface almost flat, rarely showing an ill-

defined thick area in middle of cell. Surface sculpture usually forming fine longitudinal striations, less often granular thickenings. Guard-cells rather large, only

Fig. 3.



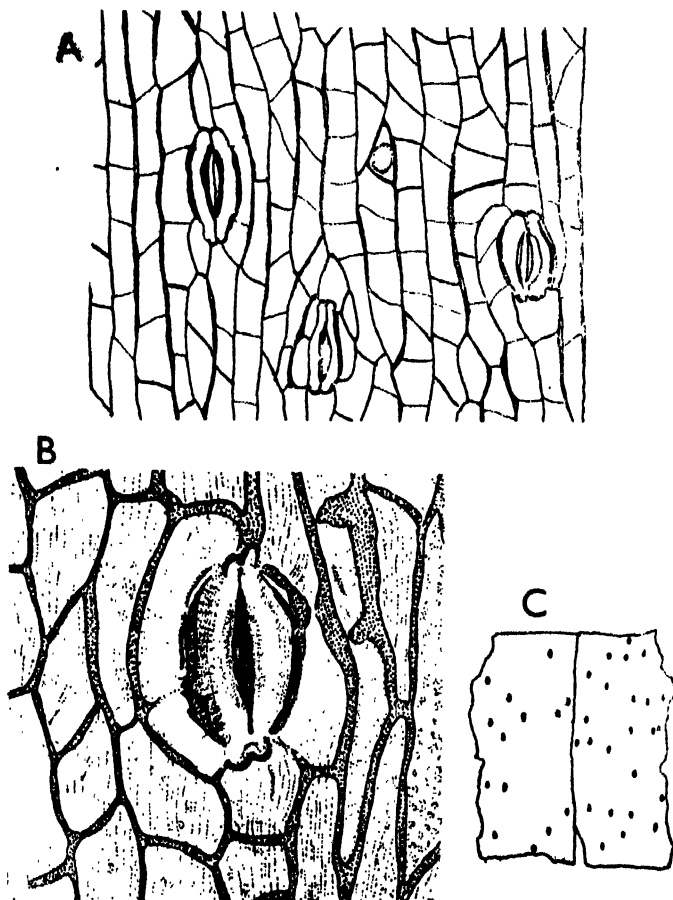
Sphenobaiera pecten.

Block showing several leaves, all on one bedding plane.
The large leaf pointing upwards is the Type.

slightly sunken, subsidiary cells irregular, lateral ones often elongated, terminal ones often apparently absent. Surface of guard-cells strongly thickened round aperture and along lateral edges, intermediate part and poles thin.

Surface of subsidiary cells thinner than other cells except near sides of stoma, where a cutinised ridge is developed ;

Fig. 4.



Sphenobaiera pecten.

- A. "Lower" cuticle showing three stomata and a trichome base ; slide B, $\times 200$. B, stoma and epidermal cells, slide A, $\times 500$. C, both cuticles of an ultimate segment (with a small amount missing along the outer edges) showing distribution and orientation of stomata, slide A, $\times 20$.

subsidiary cell ridge separated from ridge at edge of guard-cell by a thin strip. Subsidiary cells usually not

overhanging cutinised guard cell surface, occasionally overhanging to a small extent, but never forming a papilla. Encircling cells absent.

Basal cells of trichomes like other epidermal cells or smaller and thicker; surface marked with a large oval rim round a thin area; projecting part not observed.

Discussion and Comparison.—*S. pecten* is a typical *Sphenobaiera* in being a wedge-shaped leaf with no petiole, but it is unusual in being divided into remarkably slender segments. Other species of the genus have resin and have fundamentally similar cuticles. The cuticle is unusual, however, in the exposure of the guard-cells, and the thin surface of the subsidiary cells makes the stoma look peculiar.

A fragment of *S. pecten* might be indistinguishable in appearance from a fragment of various Ginkgoalean leaves with filiform segments: for instance, among Yorkshire species *Baiera furcata*, *Czekanowkia microphylla* Phillips (not yet adequately described) and some other leaves not yet described at all. A cuticle preparation, however, would distinguish it at once. It happens that no species of the genus *Sphenobaiera* has been described which has such numerous or slender segments.

18. *Equisetites lateralis* (Phillips) and its distinction from *E. columnaris* (Brongn.). (Figs. 5–7.)

Yorkshire specimens:—

- 1829. *Equisetum laterale* Phillips, p. 153, pl. x. fig. 13.
- 1836. *Equisetum laterale* Phillips, Lindley and Hutton, pl. clxxxvi.
- 1843. *Equisetites lateralis* (Phillips) Morris, p. 8. (Name.)
- 1851. *Asterophyllites ? lateralis* (Phillips) Bunbury, p. 189. (Description of leafy stem.)
- 1858. *Calamites lateralis* (Phillips) Zigno, p. 46, pl. iii. fig. 3. (Leafy stem.)
- 1875. *Equisetites lateralis* Phillips, p. 197, pl. x. fig. 13. (As 1829.)
- 1898. *Equisetites lateralis* (Phillips) Seward, p. 275, text-figs. 58 F, 63, 64.
- 1900. *Equisetites columnaris* (non Brongn.) Seward in part, text-figs. 3, 4 (as 1898, figs. 63, 64), pl. xix. figs. 4, 5. Text-fig. 3 is said to be Zigno's (1856) specimen and probably that of Bunbury (1851). Other figures represent *E. columnaris*.

See page 231 for references to similar species from other regions.

Introduction.—Phillips described *E. lateralis* from a very distinct-looking specimen and the species was generally

recognised till 1900, when Seward merged it in *E. columnaris*. Later, however, Seward (1907) described exceedingly similar material as a new species (*E. ferganensis*). The present note furnishes new information about *E. lateralis* and restores its specific rank, and certain details are also given about *E. columnaris* and the doubtful status of *E. ferganensis* is mentioned.

The present material of *E. lateralis* is from Haiburn Wyke and is of Lower Estuarine age. Some of it is in the William Reed and Herries Collections in the Yorkshire Museum, and some in the Witham Collection, Geology Department, British Museum. The specimens of *E. columnaris* described here are in the Sedgwick Museum, Cambridge. I am indebted to Messrs. R. Wagstaffe, W. N. Edwards and A. G. Brighton for lending the material.

Emended diagnosis.—Erect stems simple, usually 1·0–3·0 cm. broad, internodes usually 3–6 cm. long, smooth; nodes scarcely swollen. Leaf-sheath marked in its upper part with rather short and narrow commissural furrows usually 0·5–1 cm. long. Leaves 25–35 in a whorl, free parts stiff, about 1 cm. long, evenly tapering, diverging from the stem. Vascular bundles of stem not very woody. Internode and lower part of leaf-sheath often showing scattered stomata; upper part of leaf-sheath and leaves showing none. Cuticle thin; on internode cell-outlines not marked, but middle of cell often thickened, and surface often marked with faint mottling or transverse bars; on leaf-sheath cuticle sometimes showing cells with sinuous lateral walls and surface distinctly marked with transverse bars. Stomates oval, about $50\mu \times 35\mu$, scarcely sunken, surface not sculptured. Nodal diaphragm rigid, almost circular, concave above, consisting of an inner and an outer ring of hard tissue connected by radiating bars. Length of bar usually at least two-thirds of the radius of the diaphragm.

Cone unknown. Rhizome and roots unknown.

Description of material.—The various blocks seem to have come from a single bed in which this species is abundant, and apart from pollen grains, the only determinable fossil plant. The specimens are mostly broken and show little new about the gross form, but their fine details are excellently preserved.

An interesting feature shown by one of the widest stem fragments, fig. 5 B, is that the leaf-sheath expands above, leaving a gap between it and the tapering lower end of the internode above. The other stems show this but to a less extent, and it is not or scarcely shown in the specimens figured by other authors. None of the laterally compressed stems in this material show more than the basal part of the free leaves, but there are several specimens of free-lying nodes compressed vertically with the leaves spreading regularly, as in Seward's text-fig. 4 B. Both these and the laterally compressed specimens show the tops of the commissural flanges very clearly, and these flanges continue up the sides of the leaf-teeth as delicate, bent down margins, but disappear at about the middle of a leaf-tooth. In the six best nodes, the leaf length is 12, 11, 10, 9, 9, 7 mm. respectively, but in the laterally compressed stem figured by Seward (1900, fig. 3) they are twice this length. This specimen needs to be re-examined. In a small stem only 7 mm. wide they are particularly small, and though the apices are missing their length was estimated at about 6 mm. As far as is known the leaves are always strongly divergent, or even bent back as in Seward's 1900 fig. 3 (upside down).

The leaf-teeth are flat and always appear very stiff and their substance is dense even to the apex. They show conspicuous elongated epidermal cells on both sides, no midrib is visible and there are no stomata. The margin formed by the upward extension of the commissural flange is sharply marked off from the main part of the leaf-tooth and some minute spines are sometimes to be seen over the line of junction. These spines are 70–100 μ long and are composed of about two epidermal cells.

The surface of the internode shows no longitudinal ribbing below the level where the leaf-sheath furrows disappear, and the stomata are evenly distributed at a concentration of up to 40 per sq. mm. Some internodes show no stomata; perhaps these grew below water. The stomata usually form shallow pits, but in the specimen shown in fig. 5 C, where nothing remains of the internode but a thin surface layer, they project strongly, presumably because of the greater thickness of the walls of the guard-cells. There are several fragments of de-

corticated steles, some showing a node, but none are well preserved. In the internode there are longitudinal ridges at about 1 mm. apart, which represent vascular bundles. These ridges are not thick strands, as in a Calamite stem, but mere corrugations in an evenly thin film of coal. This is evidence that they include very little woody tissue. Close to the node, however, they do grow a little more substantial, and then at the node the ridges broaden to unite with neighbouring ridges. A leaf-tooth springs above each, and there is some evidence that the bundles of the next internode alternate. This is exactly as in *Equisetum*.

The cuticle is thin (about $1\ \mu$) but tougher than in some species and by no means difficult to prepare, in small pieces. As in certain other species it has a yellowish colour which persists through maceration. It scarcely ever shows cell-outlines, and is sometimes almost perfectly featureless, but more often there is a smooth or puckered thickening in the middle of each cell. The stomatal aperture is usually thick and strongly marked and the stomatal margins are usually distinct. No evidence was seen for the existence of lignine supporting bars in the stomata, even in pieces of epidermis which are incompletely macerated and still show epidermal cell-walls.

The leaf-sheath sometimes yields an equally featureless cuticle, but sometimes the lateral walls of the cells are shown by a thick jagged line, while the surface of the cell, which has no central thickening, is crossed by fairly conspicuous transverse ridges. Both of these features are due to a moderately resistant layer under the main cuticle and prolonged maceration removes them, leaving the cuticle featureless.

The nodal diaphragm is the most striking and characteristic organ of *E. lateralis*. Seward (1898, figs. 63, 64; 1900, text-figs. 3, 4 A) has figured laterally compressed stems still containing diaphragms, and two in this material show them; isolated diaphragms are very common on every block, and some are still connected to the leaves (fig. 5 A). Isolated diaphragms are also figured by Seward (1900, text-fig. 4 c; pl. xix. figs. 4, 5).

The true nature of these diaphragms was recognised long ago (see Seward, 1898, p. 276, for full discussion), but the stems were unfortunately described upside down.

and it was therefore supposed that the diaphragms were displaced bodily from the node as well as rotated into the plane of compression. I think, however, they have not, as a rule, moved lengthwise, but mark the node. This, therefore, lies a little below where the commissural furrows of the sheath disappear. Diaphragms in this position are familiar in other flattened *Equisetites* stems, e. g. *E. muensteri*.

A Seward remarks, the diaphragm is saucer-shaped, being round, concave above, convex below. The specimen shown in fig. 5 A, in which the leaf-sheath points upwards, proves that the concave side of the diaphragm faces upwards. The surface is characteristically marked like a cart-wheel. There is a fairly small hub which is often perforated and spokes and a rim all composed of strong, thick tissue. Their surface shows small rectangular cells with thick walls; tracheids were not recognised.

Presumably the spokes have some relation to the internodal vascular bundles and to the leaf-teeth, and it was found that the number of spokes in isolated diaphragms is about the same as the number of leaf-teeth in isolated leaf-whorls. No specimens, however, show the precise relation: in fig. 5 A, which might have done so, it seems irregular, possibly because of distortion.

The surface of the rim is not quite flat, but is distinctly elevated opposite each spoke, and the plane of cleavage may thus leave the middle of the spoke, which then looks Y-shaped. This is clearly seen in Seward's figures. Removal of the rock matrix, however, shows that the rim is entire or only slightly emarginate. In certain specimens the intervals between the spokes are occupied by delicate tissue; in one they are incompletely occupied, leaving irregular cracks. The hole in the hub is often occupied by a dome of thin tissue (obscured by damage in fig. 5 A, but figured by Seward, 1900, fig. 4 C, pl. xix. fig. 4). There is nothing to show whether the diaphragms lacking these delicate tissues in the fossil state had them when alive.

It is presumed that the delicate tissue of the diaphragm was spongy aerenchyma, and the robust hub, spokes and rim are supporting tissue, though such supporting tissue is unusual in water plants. The elevation of the rim opposite the spokes may represent the nodal masses of metaxylem.

Problematical organ.—The small fossils shown in fig. 6 C-F, H, are associated with the stems of *E. lateralis*. They are bell-shaped, being hollow truncated cones, but the sides are flattened or slightly hollowed into about six facets and the top is truncated obliquely. Seven specimens were studied and they were all much alike, except in the plane of compression. Three were dissected away: the substance is a brittle coal, very thick at the top, but growing delicate at the sides. The whole outer surface has a continuous smooth epidermis, the cells at the sides are vertically elongated and in rows, and these rows seem to extend up the oblique top. The lower margins appear broken in every specimen. There are a few obscure pits on the sides which are possibly stomata, the top, however, has none. The inner surface was not seen, but dissection shows that it is rough and adheres rather tenaciously to the matrix filling the interior. There is, however, nothing to suggest internal organs and no central stalk occurs in the three specimens dissected. Fragments yielded a very delicate cuticle showing straight-sided cells.

Whatever the nature of this fossil, it must have been attached with its broad end facing the parent plant; the epidermal covering precludes attachment by the narrow end. It could have been attached by a central stalk, as an umbrella-shaped body such as a sporangio-phore, or by the whole interior as the armoured apex of some sort of stem. The fact that no stalk is present and that the lower margin is always indefinite and broken favours the view that it is an armoured stem apex.

There is considerable resemblance to a sporangio-phore, in size, flat top and sides, but against this are the obliquity of the top, long sides, thick substance and missing stalk. If it belongs to *E. lateralis* it is to be compared with the little apical caps produced on certain shoots of *Equi etites muensteri* (Harris, 1931) and likewise found isolated in considerable numbers. No suggestion is made about function.

The Leaf-teeth of *E. columnaris*,

Certain details of the leaves of *E. columnaris* need to be described before comparison with *E. lateralis* is

attempted. Brongniart, quoted in Seward, 1900, p. 55. described the stems as "... multidentatis, dentibus brevibus, sed in acumine filiformi caduco productis." The free teeth, however, prove to be fairly short and divergent rather than caducous. Seward (1900, p. 54) described them as "linear acuminate," but it is clear that he was describing a specimen upside down and that what he called a "linear acuminate" tooth was a commissural furrow dying away below a node.

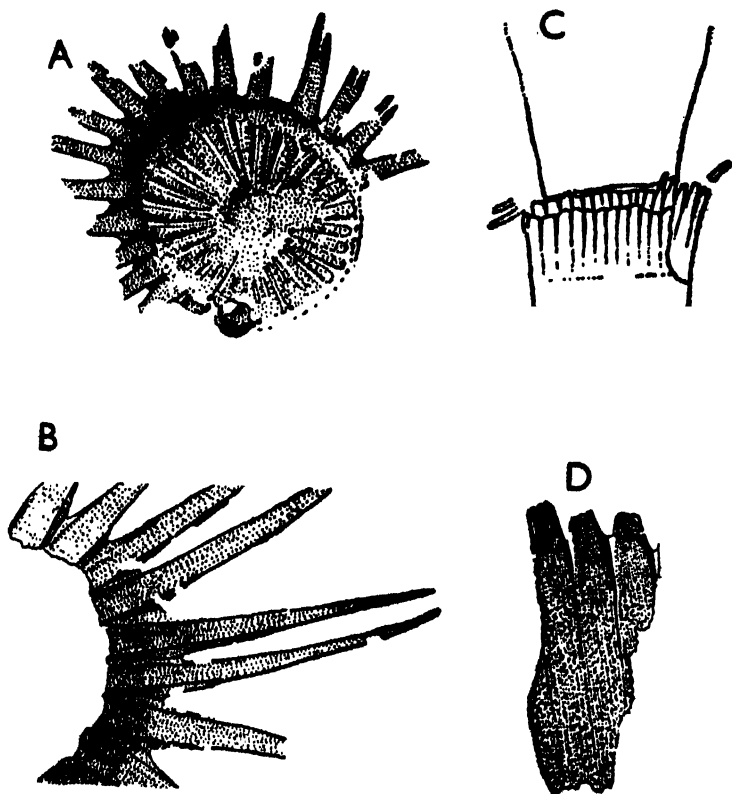
Most specimens of *E. columnaris* that have been figured are large sandstone casts of stem bases preserved erect, but ordinary crushed fragments of the small upper parts are very common in the Estuarine series. In nearly all the material the leaves have broken off at the top of the sheath, either before preservation or when the specimen was cleaned. A sandstone cast in the Sedgwick Museum (Wiltshire Coll. 10) has, however, not been fully cleaned and the free leaves, though poorly preserved are seen to diverge and extend 2-3 mm. They are more distinct in two ironstone casts of isolated nodes. In this matrix little deformation appears to have occurred, but the plant substance has been largely replaced by a white mineral. In both specimens the sheath suddenly enlarges near its top and then the separate leaves depart, making an angle of about 70° with the stem. In the smaller specimen (Leckenby Coll. 25), a stem only 15 mm. wide and with about 38 leaves, the free leaves are about 2 mm. long. In the larger specimen (G. B. Strutt Coll., no number), a stem 28 mm. wide, the number of leaves is estimated at about 60 and the free teeth are about 4 mm. long. The cast shows the inner surface of the sheath and the tops of the commissures (raised in this specimen) stand out remarkably strongly so as to make a pleated surface. Just below is a strong transverse furrow which is of unknown nature, being too high to mark the diaphragm.

Comparison of E. lateralis and E. columnaris.

Certain differences between *E. lateralis* and *E. columnaris* were missed because many of the specimens were described upside down, thus confusing all leaf-sheath characters, and also because certain corresponding organs of the two

species were not known. Both need further study, but some clear differences are now established.

Fig. 5.

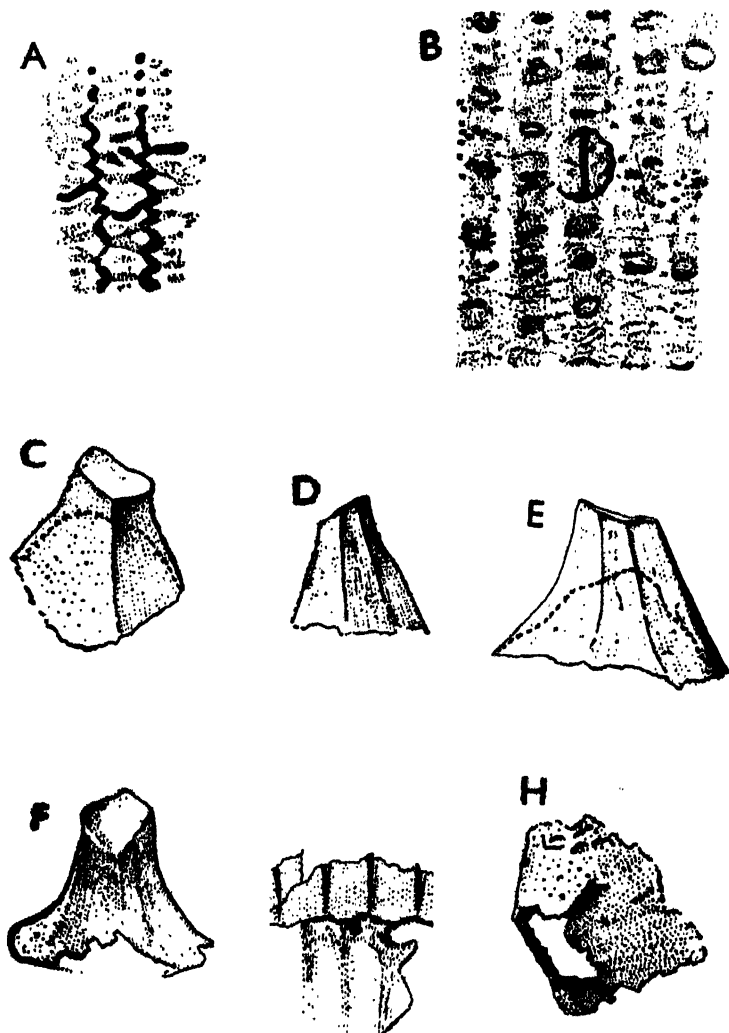


Equisetites lateralis.

A, nodal diaphragm and part of leaf-whorl, V. 26892, $\times 2$. The conical body at the base is figured again in 6 H. B, leaves, V. 26893, $\times 4$. C, laterally compressed stem with internode expanding upwards. Both sides of the leaf-sheath are exposed. Dotted lines represent features shown by the counterpart only; V. 26891, $\times 1$. D, top of leaf-sheath and bases of free teeth from V. 26891 (counterpart of C), $\times 4$.

(1) *E. columnaris* probably has a thicker stem, perhaps twice as thick. This assertion must be qualified, however, *Ann. & Mag. N. Hist.* Ser. 11. Vol. xii. 17

Fig. 6.



Equisetites lateralis and problematical organ.

A, cuticle of leaf-sheath, portions of sinuous cell-walls are still present, V. 26895, $\times 200$. B, cuticle of internode showing a stoma, V. 26896, $\times 200$. C-F, H, problematical associated organ, all $\times 10$. The specimens shown in C and E were dissected and ultimately destroyed, the broken line represents the limit of the matrix, above this is solid coaly matter. D, is V. 26893. F, is V. 26894. H, is V. 26892: the coaly matter has broken away from the top. G, base of a leaf-sheath below which are faint impressions suggesting vascular bundles, V. 26891, $\times 4$.

because no stem bases of *E. lateralis* have been recognised, and so the widest specimens may never have been seen. The largest known stems of *E. lateralis* are about 3 cm. wide, the majority are 1.5 cm. wide. The largest stems (stem bases) of *E. columnaris* are 6 cm., and many are 4 cm. Among broken material representing the top of *E. columnaris*, however, are plenty of stems less than 2 cm. wide.

(2) A typical leaf-whorl in *E. columnaris* has 50–80 leaves; a typical whorl of *E. lateralis* has only about 30, often fewer, and no specimens are known with many more. Some of the smallest stems of *E. columnaris*, however, have barely 30 (Harris, 1941).

(3) The free leaves are about 1 cm. long in *E. lateralis*, only 2–4 mm. in *E. columnaris*. In both they diverge from the stem and narrow to a point, but as their width at the base is about 1 mm. in each species, they taper more gradually in *E. lateralis*.

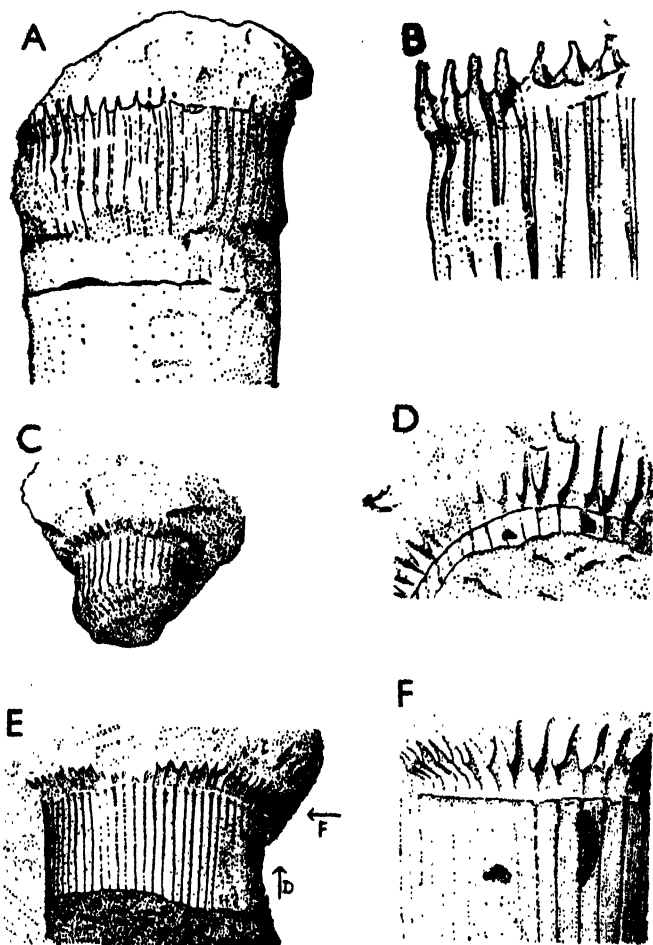
(4) At the top of the leaf-sheaths, the commissures are usually wider than the leaf-teeth segments in *E. columnaris*, but the leaf-tooth segments are wider in *E. lateralis*. In *E. lateralis* and small stems of *E. columnaris* the commissural furrows may die away after about 1 cm., but in large stems of *E. columnaris* they usually persist for 2 cm. or more.

(5) Although the surface markings and cuticles are very similar, they are distinguishable, because both the ordinary epidermal cells and also the stomata of *E. columnaris* are twice as large as those of *E. lateralis*. This statement is based on several specimens of each species.

(6) The nodal diaphragms are entirely different. That of *E. columnaris* appears to be rather delicate and is seldom preserved. Its surface shows only a ring of little tubercles, perhaps nodal metaxylem. The diaphragm of *E. lateralis* is rigid and abundant and shows long radiating spokes.

Many specimens from the Jurassic rocks of various parts of Asia have been described as *E. ferganensis* Seward. They are summarised by Kawasaki, 1939, p. 9. Their size is similar to that of *E. lateralis*, and their free

Fig. 7.



Equisetites columnaris. Specimens in the Sedgwick Museum, Cambridge.

- A, upper node of a cylindrical specimen, the next node is 11 cm. below. The internode above was lost before preservation. Wiltshire Collection 10, $\times 1$. B, leaves from this specimen, $\times 2$. C, isolated node and leaf-sheath in ironstone, Leckenby Collection 25, $\times 1$. D, leaves of specimen shown in E, viewed from below as indicated by the arrow, $\times 2$. E, isolated leaf-sheath preserved as internal cast in ironstone, Strutt Collection 1922 (unnumbered), $\times 1$. The commissural flanges at the top of the leaf-sheath are strongly raised. F, the same leaves as in D, but viewed laterally as indicated by the arrow in E.

leaves and isolated diaphragms are almost the same, and many of them might reasonably be included in *E. lateralis*. Indeed, Sze (1931, p. 51, pl. v. fig. 4, and 1933, p. 69, pl. ix. fig. 7) uses the name *E. cf. lateralis* for some Chinese specimens.

The original specimens of *E. ferganensis* (Seward, 1907) are perhaps distinguished by the diaphragm spokes being relatively shorter; in *E. lateralis* they are usually more than half the radius, while in the original *E. ferganensis* and many other specimens they are half as long or less. Again, in *E. lateralis* the diaphragms are round or only slightly oval, while in *E. ferganensis* they are often markedly oval. *E. blandum* Raciborski (1894) appears also to be very similar, though only very small stems are known. *E. rotiferum* Tenison-Woods (see Walkom, 1915) has also a similar diaphragm.

I consider that although these slight differences in the relative size of parts of the diaphragms may point to real specific difference, they scarcely, in themselves, constitute a valid specific difference. More definite characters are needed.

The position of *E. lateralis* in the genus *Equisetites* need not be disturbed. Heer and Schimper (see Seward, 1898, p. 276) suggested that the spreading leaves agreed rather with *Phyllothea* or *Schizoneura*; but it is shown here that they are similarly spreading in the more *Equisetum*-like species, *E. columnaris*. Moreover, the leaves of *E. lateralis* appear to be mere stiff scales, while the figures of the leaves in *Phyllothea* give the impression that they were green photosynthetic organs.

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XXIII.—*New or little-known Tipulidæ (Diptera).*—LXXIII.
Neotropical Species. By CHARLES P. ALEXANDER,
 Ph.D., F.R.E.S., Massachusetts State College, Amherst,
 Massachusetts, U.S.A.

THE various novelties discussed herewith are from Peru, where they were collected chiefly by Messrs. Pedro Paprzycki and Felix Woytkowski, to whom our greatest advance in knowledge of Peruvian crane-flies is due. The types of the species are preserved in my personal collection of Tipulidæ.

Tipula (Eumicrotipula) conspiciata, sp. n.

Belongs to the *glaphyroptera* group; mesonotal præscutum obscure yellow, with four brown stripes; posterior sclerites of mesonotum with wide central markings; antennæ (male) elongate, about one-half the body, flagellar segments bicoloured; halteres yellow; femora brownish yellow, each with two black subterminal rings enclosing a subequal yellow ring, the actual tip again narrowly yellow; wings broad, pale yellow, the costal border more saturated; an unusually conspicuous and contrasted brown pattern; male hypopygium with the ninth tergite narrowly transverse, the produced central portion with a very shallow U-shaped notch; eighth sternite with a flattened median lobe that is slightly more than twice as long as its width across base.

Male.—Length about 14 mm.; wing 14 mm.; antenna about 7.5 mm.

Frontal prolongation of head obscure brownish yellow; nasus long and conspicuous; palpi with first segment

obscure yellow, the remainder broken. Antennæ (male) elongate, approximately one-half the length of either body or wing; scape brownish yellow, pedicel clearer yellow; flagellar segments conspicuously bicoloured, the basal swelling black, the succeeding portions of the stems infuscated, the outer portions becoming clear yellow, this bicolourous nature continuing through the penultimate segment; flagellar segments elongate, gently incised, the outer portion of the stem a little expanded; longest verticils a trifle shorter than the segments. Head brownish fulvous; vertical tubercle simple but relatively conspicuous; front and anterior vertex yellow, the centre of the latter infuscated, with a narrow median vitta immediately behind.

Pronotum obscure yellow, with three brown marks; anterior pretergites opposite the foveæ conspicuously blackened. Mesonotal præscutum with the ground obscure yellow, with four brown stripes that are narrowly and vaguely bordered by slightly darker brown; intermediate stripes vaguely separated on the cephalic third only, confluent behind; lateral præscutal border behind the foveæ infuscated; præscutal vestiture short and inconspicuous; scutum obscure yellow, each lobe chiefly covered by two separate brown marks; scutellum obscure yellow, its central portion extensively infuscated; mediotergite broadly darkened on central portion, especially behind, the lateral borders obscure yellow; pleurotergite with its anapleurotergite obscure yellow, more infuscated in front, the katapleurotergite conspicuously dark brown. Pleura obscure yellow, the propleura dark brown. Halteres yellow. Legs with coxæ obscure yellow, narrowly more infuscated basally; trochanters yellow; femora brownish yellow, clearer basally, with two conspicuous blackened subterminal rings that enclose a subequal clear yellow one, the extreme tip very narrowly yellow; remainder of legs pale yellowish brown, the outer tarsal segments darker. Wings broad; ground-colour pale yellow, conspicuously patterned and variegated with dark brown subcostal areas and very slightly paler clouds in most of the cells; cells *C* and *Sc* more saturated yellow; the darker subcostal areas include a major basal one extending from *h* across the bases of cells *R* and *M* into *Cu*; second and third areas in cell *Sc*, not involving

cell *Sc*, behind extending about to mid-width of cell *R*, interconnected by a narrow linear dark central streak; fourth dark area small, at outer end of cell *Sc*; fifth and last area at stigma; the darkened clouds of remainder of wing exceed in area the yellow ground except in the central portion of cells *R* and *M*; post-stigmal ground area extending into cell *R*₅; a narrower pale area across cell 1st *M*₂ from the outer end of cell *R* to beyond mid-length of cell *M*₃; cell *M*₁ with pale spot near base, cells 2nd *M*₄ to *M*₄, inclusive, with similar pale marginal spots; basad of cord, in cells *Cu* through 1st *A*, the dark pattern becomes more irregular and zigzag; veins brown, yellow in the ground areas. Venation: *R*₁₊₂ entire; *Rs* about twice *m-cu*; vein *R*₃ almost straight, not sinuous as in *juventa*; petiole of cell *M*₁ subequal in length to the cell.

Basal abdominal tergites obscure brownish yellow, on sides narrowly patterned with dark brown, the outer segments becoming somewhat more uniformly darkened; sternites clear yellow; hypopygium chiefly yellow. Male hypopygium with the ninth tergite narrowly transverse, its width exceeding twice the greatest length; central portion produced, with a further shallow U-shaped median notch; lateral angles obtuse. Lobe of basistyle nearly circular in outline, covered with short dense setulæ. Outer dististyle long and slender, only a trifle expanded on distal half. Inner dististyle elongate, slightly more dilated across base, the outer surface and margin with unusually few setæ. Ninth sternite with the lobe suboval, with several very long setæ, the longest exceeding the lobe itself. Eighth sternite with the caudal margin truncate, with a conspicuous depressed median lobe that is slightly more than twice as long as the width across base.

Hab. Peru (Junin).

Holotype, ♂, Monobamba, Tarma, altitude 6000 feet, December 3, 1940 (*Woytkowski*).

Tipula (*Eumicrotipula*) *conspicillata* is generally similar to species such as *T. (E.) arecuna* Alexander, *T. (E.) browniana* Alexander, *T. (E.) delectata* Alexander, and *T. (E.) juventa* Alexander, especially the latter. It differs particularly in the elongate antennæ of the male, the coloration of the body, legs and wings, and in all details of structure of the male hypopygium.

Tipula (Eumicrotipula) huanca, sp. n.

Belongs to the *glaphyoptera* group; size large (wing, female, about 20 mm.); general coloration grey, patterned with brown; antennæ black, the pedicel a little more reddened; knobs of halteres blackened; legs black, the broad central portion of tibiæ paler: wings relatively narrow, whitish subhyaline, conspicuously clouded and marbled with dark brown, pale brownish grey and buffy; cell 1st M_2 narrowed at its outer end; abdomen chiefly reddish brown, more or less distinctly striped with blackish; posterior lateral borders of intermediate tergites with conspicuous light grey areas.

Female.—Length about 22 mm.; wing 20.5 mm.; antenna about 3.4 mm.

Frontal prolongation of head dark grey above, dark brown beneath, of moderate length, being about three-fourths the remainder of head; nasus lacking; palpi black. Antennæ (female) black, the pedicel more reddened, scape slightly pruinose; flagellar segments with feebly-developed basal enlargements; longest verticils unilaterally distributed. Head grey; posterior vertex with a conspicuous dark brown median area that is narrowed in front; vertical tubercle very low.

Pronotum grey, restrictedly darkened medially. Mesonotal præscutum light grey, with dark brown markings, as follows:—The normal four stripes are much reduced, the intermediate pair being represented by washes and individual spots, separated by a capillary dark brown median vitta; sublateral stripes short and relatively small but entire; interspaces with a few scattered setigerous punctures that bear very inconspicuous setæ; scutum clear light grey, each lobe with two small, disconnected brown spots, the median area weakly darkened; scutellum grey, with a conspicuous central darkening, parascutella slightly darker; mediotergite grey, with a more or less distinct central infuscation on its cephalic portion; pleurotergite variegated brown and light grey. Pleura patterned with light and dark grey, the latter especially evident on the ventral sternopleurite, the anepisternum even more conspicuously patterned with blackish; anterior dorso-pleural membrane surrounding the spiracle light yellow, the posterior membrane dark brown. Halteres relatively long,

stem yellow, knob blackened. Legs with coxæ grey; trochanters dark brown; femora black, the bases narrowly reddened; tibiæ with both ends narrowly blackened, the extensive central portion paler; tarsi black. Wings with the ground whitish subhyaline, very heavily clouded and marbled with dark brown, pale brownish grey and buffy; prearcular field and cell *C* chiefly light brown; cell *Sc* yellow, with three dark brown clouds as described below; a clear light yellow spot at arculus; the darkest areas are subcostal in distribution, including one at origin of *Rs* and a second just basad of it, both involving cell *Sc* as well as *R* but not reaching vein *M* behind; stigma and a confluent seam over anterior cord dark brown; narrower dark brown seams over posterior cord, outer end of cell 1st *M*₂ and on the veins beyond cord; restricted dark brown areas near arculus and over outer end of cell *Sc*; paler brownish-grey washes in the centres of the outer cells to form a very zigzag pattern in cells *M* to 2nd *A*, inclusive, in cells *M* and *M*₄ merging into buffy margins; the subhyaline ground does not form uninterrupted bands either before or beyond the stigma; veins dark brown, somewhat paler in the more brightened costal field. Wings much narrower than in *mocoa*. Venation: Extreme tip of *R*₁₊₂ atrophied; vein *R*₂ very short, cell *R*₂ pointed at base; *Rs* unusually long, about two-and-one-half times the long *m-cu*; cell 1st *M*₁ narrowed at its outer end; petiole of cell *M*₁ nearly twice *m*; vein 2nd *A* nearly straight.

First abdominal tergite brownish grey; succeeding tergites with the ground reddish brown, with a more or less distinct more blackened lateral stripe, the lateral margin of posterior half of each segment heavily and conspicuously light grey pruinose, forming a series of six marks on either side of abdomen; sternites reddish brown, patterned laterally and along the centre with darker; genital shield reddish brown; ovipositor with cerci long and straight, reddish brown.

Hab. Peru (Ayacucho).

Holotype, ♀, Yanamonte, La Mar, in fog forests, altitude 3000—4100 metres, September 26, 1941 (*Woytkowski*); in bushy thickets along brook-margin.

The specific name, *huanca*, is that of a native Peruvian tribe. From other approximately similar species having

marbled wings, including *Tipula* (*Eumicrotipula*) *mocoa* Alexander, of Colombia, the present fly differs in the coloration of the body, legs and wings, and in the narrower wings with distinct venational details.

Tipula (*Eumicrotipula*) *immorsa*, sp.n.

Belongs to the *monilifera* group; general coloration of notum fulvous brown, the præscutal stripes poorly differentiated; antennæ (male) almost as long as body, basal flagellar segments weakly bicolored, the outer ones uniformly blackened; thoracic pleura uniform yellow; femora obscure yellow, the tips blackened; wings strongly suffused with fulvous brown, very restrictedly patterned with darker brown and whitish subhyaline; abdominal tergites trivittate with brownish black, on the subterminal segments forming a blackened ring; hypopygium yellow, the ninth tergite with a broad caudal emargination, bearing at its base a second narrower median notch; outer dististyle dilated on outer half; inner dististyle with a row of strong bristles on distal half of outer margin; lobe of eighth sternite unusually short and broad, only about as long as the width across the base.

Male.—Length about 12–13 mm.; wing 16–17 mm.; antenna about 10.5–11 mm.

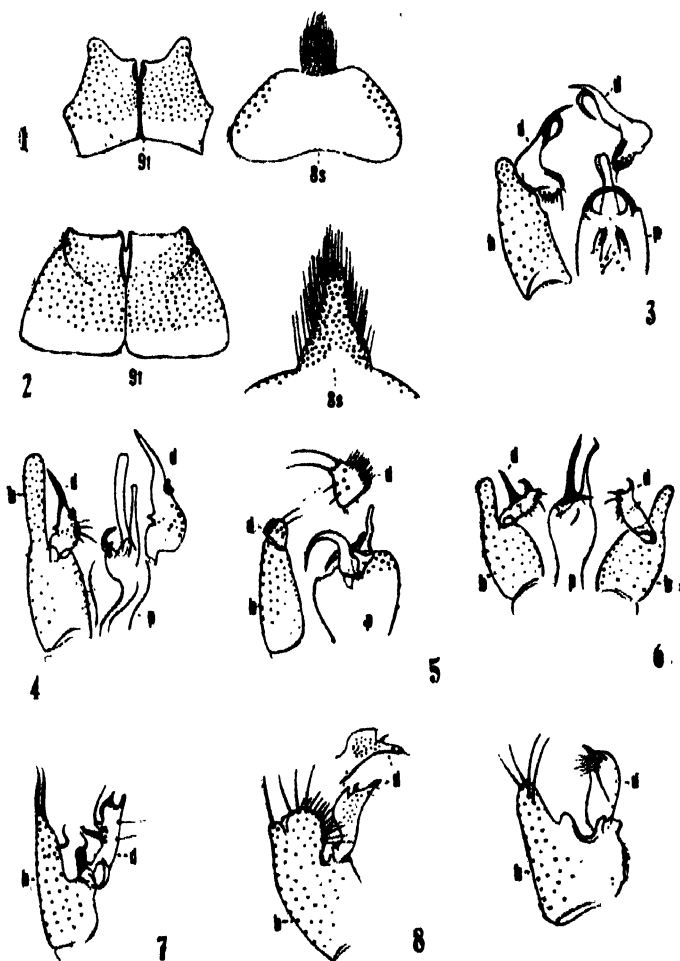
Female.—Length about 18–19 mm.; wing 17.5–18 mm.

Frontal prolongation of head yellow above, including the long nasus, infuscated on sides, particularly just cephalad of the eyes; palpi brownish black, the incisures and apex of terminal segment a trifle brightened. Antennæ (male) with the scape and pedicel yellow; basal flagellar segments brown, the basal knots black, the outer segments becoming uniformly black; segments beyond the abrupt knot uniformly cylindrical. In female, antennæ small and simple. Head buffy yellow, with a capillary black median vitta.

Pronotum and mesonotum chiefly fulvous brown, the præscutal stripes poorly differentiated from the ground; in cases, the stripes a little darker and more conspicuous, with a further dark capillary median vitta; interspaces with very conspicuous black setigerous punctures; scutal lobes again vaguely patterned with darker; scutellum with a linear black median dash on basal portion. Pleura and pleurotergite, including the dorsopleural membrane,

yellow. Halteres with stem brown, the base narrowly light yellow, the knob blackened. Legs with the coxæ and trochanters yellow; femora obscure yellow, the tips blackened; tibiæ and basitarsi dark brown; outer tarsal segments black; claws (male) with a very weak denticle. Wings very strongly suffused with fulvous brown, very restrictedly patterned with darker brown and whitish subhyaline; dark areas include the stigma and an adjoining cloud on the anterior cord, with restricted areas in the prearcular field and vicinity of the arculus; the subhyaline areas include a restricted, incomplete, post-stigmal area across the bases of the outer radial cells; a similar, disconnected area in cell 1st M_2 , crossing into cells R and M_3 ; a very inconspicuous pale area near outer end of cell R_5 ; very restricted pale marks beyond mid-length of cells R and M and on basal half of Cu , where they alternate with darker clouds; cell 1st A with two vague brightenings on proximal half, the remainder of anal cells uniformly of the ground-colour; cells C and Sc slightly darker than the remainder of ground, unpatterned; veins dark brown. In the female, wing-pattern somewhat better indicated. Venation: R_{1+2} entire; m longer than the petiole of cell M_1 .

Abdominal tergites yellow, heavily and conspicuously trivittate with brownish black, increasing in amount on the outer segments and here restricting the yellow ground; segments six to eight, inclusive, chiefly blackened; sternites and hypopygium yellow. In cases, the median tergal stripe poorly indicated on the more basal sclerites. Male hypopygium (fig. 1) with the tergite, 9t, broadly transverse, the caudal margin with a very broad and shallow emargination, with a further deep and narrow median notch; dorsal surface of tergite with a median groove for the entire length, much widened on more than the posterior half of sclerite; lateral tergal lobes obtusely rounded. Outer dististyle conspicuously dilated on its outer half, where it is more than three times as wide as it is across the stem. Inner dististyle with the beak unusually long, not heavily blackened; setæ of distal half of outer margin forming a strong row, the more basal ones becoming very small and delicate. Basistyle entire, without a lobe. Lobe of ninth sternite small, elongate-oval, with apical setæ that exceed it in length. Lobe



- Fig. 1.—*Tipula* (*Eumicrotipula*) *immorsa*, sp. n.; male hypopygium.
 Fig. 2.—*Tipula* (*Eumicrotipula*) *yanamonteana*, sp. n.; male hypopygium.
 Fig. 3.—*Gonomyia* (*Lipophleps*) *mythica*, sp. n.; male hypopygium.
 Fig. 4.—*Gonomyia* (*Lipophleps*) *dotata*, sp. n.; male hypopygium.
 Fig. 5.—*Gonomyia* (*Lipophleps*) *scelerata*, sp. n.; male hypopygium.
 Fig. 6.—*Gonomyia* (*Lipophleps*) *philomela*, sp. n.; male hypopygium.
 Fig. 7.—*Styringomyia* *mystica*, sp. n.; male hypopygium.
 Fig. 8.—*Styringomyia* *americana* Alexander; male hypopygium.
 Fig. 9.—*Styringomyia* *simplex*, sp. n.; male hypopygium.

(Symbols: *b*, basistyle; *d*, dististyle; *p*, phallosome;
s, sternite; *t*, tergite.)

of eighth sternite, 8s, unusually short and broad, its length about equal to the width across base, provided with numerous long yellow setæ; remainder of sternite with central portion without major setæ, these represented by about 15 to 18 on either side.

Hab. Peru (Junin).

Holotype, ♂, Carpapata, Tarma, altitude 2600 metres, May 10, 1940 (*Woytkowski*). *Allotopotype*, ♀, pinned with type. *Paratopotypes*, 3 ♂♂, 1 ♀, May 4-6, 1940 (*Woytkowski*).

The present fly is readily told by the coloration of the body and wings, in conjunction with the structure of the male hypopygium, especially the tergite, outer dististyle and eighth sternite. In the small lobe of the latter the fly is most similar to species such as *Tipula* (*Eumicrotipula*) *armillata* Alexander, of Colombia.

Tipula (*Eumicrotipula*) *yanamontana*, sp. n.

Belongs to the *monilifera* group; mesonotal præscutum yellow, heavily patterned with brown, including four medium brown stripes and an additional brownish-black capillary median vitta; antennæ elongate, about two-thirds the length of body; halteres blackened; femora pale brown, the tips brownish black; wings whitish subhyaline, with a very heavy contrasted dark brown pattern; male hypopygium with the caudal margin of tergite having a small median notch, the very broad lateral lobes truncated; lobe of eighth sternite broad at base, narrowed outwardly, provided with conspicuous setæ.

Male.—Length about 17 mm.; wing 19.5 mm.; antenna about 12 mm.

Frontal prolongation of head elongate, slightly exceeding the remainder of head, obscure brownish yellow, sparsely pruinose above, including nasus, the sides dark brown; palpi black. Antennæ (male) elongate, approximately two-thirds as long as body; scape and pedicel light yellow; first flagellar segment pale brown, succeeding segments weakly bicoloured, the abrupt basal knot black, the pedicel medium brown, on the outer segments the color almost uniformly blackened. Head buffy, more yellowed on front, with a narrow black median vitta on vertex.

Pronotum light grey, with three brown areas. Mesonotal præscutum with the ground-colour yellow, patterned with brown, including four medium brown stripes and isolated blackened borders; intermediate stripes separated by a conspicuous brownish-black capillary median vitta, all three stripes becoming confluent behind; interspaces with very conspicuous dark brown setigerous punctures that become more or less confluent; scutum brownish grey, conspicuously patterned with brown, especially on the lobes; scutellum medium brown, slightly darker medially at the base but not forming a stripe; mediotergite brownish grey, the central portion narrowly darkened, the sides less evidently so; posterior border with a pair of circular, more buffy spots. Pleura and pleurotergite chiefly greyish yellow, very vaguely and indistinctly patterned with pale brown. Halteres elongate, blackened, the base of stem restrictedly yellow. Legs with the coxæ greyish yellow; trochanters pale yellow; femora pale brown, narrowly clear yellow at bases, the tips rather narrowly brownish black; tibiæ pale brown, the tips more narrowly blackened; proximal tarsal segments pale brownish yellow, the outer ones blackened. Wings whitish subhyaline, heavily patterned with dark brown, the dark colour much exceeding the pale, the areas highly contrasted; the white appears as a broad post-stigmal stripe extending from *C* into the base of cell M_3 ; an isolated longitudinal area near wing tip, including the distal end of cell R_5 , nearly the basal half of M_1 and tiny droplets in 2nd M_2 ; cell R_1 largely white, the area crossing R_5 at near mid-length into cell *R*; a major oblique white area crosses both cells *R* and *M* at near mid-length of wing; basad of this, cells *R*, *M*, *Cu* and 1st *A* all with white areas, in the last-named irregular in outline and restricted to the proximal half of cell; axillary third of cell 2nd *A* whitened; markings near base of cell *M* and outer part of *Cu* more yellowed; cell *C* uniformly brown, cell *Sc* only vaguely patterned by the darker areas; veins brown, paler where the white areas are traversed. Venation: R_5 a little less than twice $m-cu$; cell 1st M_2 large; petiole of cell M_1 shorter than *m*.

Abdominal tergites fulvous yellow, trivittate with brown, the lateral stripes becoming much darker and wider on the outer segments, though interrupted by the

pale posterior borders of the segments and partially by the more yellowed basal tergal rings; sternites yellow, the subterminal segments more extensively darkened, including the broad basal portion of the ninth tergite, the eighth sternite and most of the basistyles; remainder of hypopygium yellow. Male hypopygium (fig. 2) with the tergite, 9t, narrowed outwardly, the lobes truncated and with both the outer and the inner angles a trifle produced; a small, narrow, median notch, with a further dorsal groove extending the whole length of the sclerite, broadest on the posterior half. Inner dististyle with setæ of outer margin strong, those of proximal half much more delicate. Basistyle and ninth sternite without developed lobes. Gonapophyses appearing as broadly flattened pale plates, the tips obtusely rounded. Eighth sternite, 8s, with the lobe moderately long, broadest across base thence strongly narrowed, the length approximately twice the width across base; surface with abundant long coarse setæ.

Hab. Peru (Ayacucho).

Holotype, ♂, Yanamonte, La Mar, in fog forests, altitude 3000-4100 metres, September 3, 1941 (*Woytkowski*).

The pattern of the wings of the present fly is almost as in *Tipula* (*Eumicrotipula*) *woytkowskiana* Alexander, of Peru, but the structure of the male hypopygium is quite distinct. This latter species is one of the few members of the *monilifera* group having a median tooth on the tergite of the male hypopygium instead of a notch, as in the present fly.

Tipula (*Eumicrotipula*) *chanca*, sp. n

General coloration of mesonotum almost unicolorous brown, virtually unpatterned except for a blackened U-shaped mark at suture and paired brown areas on posterior portion of mediotergite; posterior portion of vertex dark brown, sending a median spur cephalad onto the brownish-yellow anterior vertex; halteres relatively long, dark brown; femora obscure yellow, the tips blackened; wings whitish subhyaline, handsomely patterned with dark brown and paler brownish grey; abdominal tergites yellow, with three interrupted brown stripes; subterminal segments blackened.

Female.—Length about 17 mm.; wing 18 mm.

Frontal prolongation of head obscure brownish yellow, darkest outwardly, including the long conspicuous nasus; palpi black. Antennæ with scape and pedicel yellow, the basal flagellar segments more obscure yellow, the outer ones passing into brown; flagellar segments subcylindrical, beyond the second a trifle produced at base and here provided with long setæ; terminal flagellar segment elongate, a little exceeding the penultimate. Anterior vertex rich brownish yellow, the posterior portion dark brown, sending a median spur forward almost to the level of the antennæ; posterior orbits narrowly light gray; no vertical tubercle.

Pronotum uniformly brown. Mesonotal præscutum almost unicolorous brown, the surface with four stripes that are scarcely differentiated from the slightly more yellowish ground; at the suture a conspicuous U-shaped blackened mark; no conspicuous setigerous punctures on the interspaces, the setæ exceedingly delicate; posterior sclerites of notum similarly brown, the mediotergite conspicuously patterned with dark brown, appearing as a major oval area on either side of a delicate yellow mid-line; pleurotergite infuscated, its cephalic portion paling to yellow. Pleura yellow, the dorsopleural membrane a trifle darker. Halteres relatively long, dark brown, the extreme base of stem yellow. Legs with the coxæ yellow, trochanters more greenish yellow; femora obscure yellow, the tips rather narrowly but conspicuously blackened, the amount subequal on all legs; tibiæ and basitarsi obscure brownish yellow, the tips more narrowly darkened; outer tarsal segments passing into black. Wings with the ground-colour whitish subhyaline, with a very heavy dark brown and paler brownish-grey pattern; the dark brown arranged as follows:—A major area over *h* and the bases of cells *R* and *M*, more extensive in *R*, interconnected with a second area about mid-distance to origin of *Rs*; origin of *Rs* reaching *M* behind; stigma and a confluent seam on anterior cord, the former darker, without trichia; outer radial field and a backward prolongation across *m*; a major cloud at near mid-length of cell *M* adjoining vein *Cu*; *m-cu* and broad adjoining portions of vein *Cu*, including all of the distal section; a smaller area near base of cell *Cu*; the paler

brown washes include the outer medial, cubital and anal fields, in cell 1st *A* enclosing a large whitish droplet; the white pattern includes a broad post-stigmal band from costa to vein M_{1+2} , there narrowly separated from the chiefly white cell 1st M_2 ; outer end of cell R_5 and sub-basal portions of cells M_1 to M_4 whitened; before the 2nd an irregular white pattern fills most of the area in cells R_1 , R , M , the interspaces of *Cu*, and the broad axillary field of the anal cells; cell *C* brownish yellow, whitened at distal end; cell *Sc* light yellow, with the four brown areas above described; veins brown, paler brown in the brightened costal interspaces. Venation: R_{1+2} entire but pale and with trichia only on basal portion; *m* longer than petiole of cell M_1 ; vein 2nd *A* a little sinuous on its distal quarter.

Abdominal tergites yellow, with an interrupted dark brown sublateral stripe, pale at base and apex of each segment; on the third and succeeding tergites with a similar median brown vitta; sternites light yellow, the caudal margins of outer segments narrowly more darkened; subterminal tergites and sternites, including the genital shield, conspicuously blackened. Ovipositor with the cerci long and slender, nearly straight, horn-yellow.

Hab. Peru (Ayacucho).

Holotype, ♀, Yanamonte, La Mar, in fog forests, altitude 3000–4100 metres, September 29, 1941 (*Woytkowski*).

The specific name, *chanca*, is that of an aboriginal tribe inhabiting Ayacucho. From the structure of the female antennæ, I am inclined to believe that this fly will be found to belong to the *monilifera* group, where, also, the nature of the wing-pattern agrees well. The species is distinguished by the almost unpatterned mesonotum and the peculiar coloration of the dorsum of the head. Superficially it resembles species such as *Tipula* (*Eumicrotipula*) *callisto* Alexander, from the same general region, but there is no close relationship.

Teucholabis (*Paratropesa*) *prænobilis*, sp. n.

General coloration of body polished black, the anterior portion of pronotum yellow; all legs having a different colour-pattern, as in *heteropoda*; wings whitish, heavily patterned with brown, appearing as three complete or nearly entire cross-bands; *Rs* strongly arcuated; abdomen

black, narrowly ringed with yellow; male hypopygium with the apical spine of the outer dististyle short; inner dististyle bilobed, simple in structure.

Male.—Length about 6.5 mm.; wing 5.6 mm.

Rostrum obscure yellow; palpi brownish black. Antennæ with scape yellow, pedicel brownish yellow, flagellum black; flagellar segments oval. Head with front and anterior portion of vertex yellow, the major portion of vertex black, the extreme posterior border of head obscure yellow.

Pronotum yellow in front, black behind. Mesothorax uniformly polished black, the scutal lobes with violaceous reflexions; pleura weakly pruinose on mesepimeron and metapleura; dorsopleural membrane pale. Halteres with base of stem narrowly yellow, the remainder blackened, knob pale yellow. Legs with fore coxæ yellow, remaining coxæ black; fore and middle trochanters obscure yellow, posterior pair black; fore legs black, the basal fourth of femora yellow; middle femora yellow, with about the distal fifth blackened; tibiæ and proximal two segments of tarsi obscure brownish yellow, outer tarsal segments blackened; hind femora narrowly yellow at base, followed in turn by a broad black ring, a subequal subterminal yellow annulus and a slightly narrower black, almost terminal band, the yellow annulus involving nearly one-third the total length of the segment; tibiæ brown; basitarsi obscure yellow, the outer tarsal segments passing into black; posterior basitarsi slightly dilated at base. Wings whitish, heavily patterned with dark brown, appearing as three hands; basal dark area at and beyond arculus, extending from *C* to vein 2nd *A*, widest in the uniformly darkened cells *C* and *Sc*, narrowed posteriorly, the portion in cell 1st *A* slightly disconnected from the main area; second band at cord, extending from *C* to vein *Cu*, narrowed behind, slightly interrupted above the fork of *M*, in cells *Cu* and 1st *A* reaching the posterior border as a much paler wash; third band involving the wing tip, extending basad to the general level of fork of *R*₃₊₄ and outer end of cell 1st *M*₂, becoming paler and less evident in the outer medial cells; origin of *Rs* very narrowly seamed with brown; veins pale brown, somewhat darker in the patterned areas. Venation: *Rs* strongly arcuated; *R*₂ in alignment with *r-m*, about one-

fourth its length beyond the fork of R_s ; R_{3+4} a little longer than R_4 ; vein R_3 suberect; $r-m$ elongate; cell 1st M_2 long and narrow, widened outwardly, subequal in length to vein M_{1+2} beyond it; $m-cu$ about one-fourth its length before the fork of M ; cell 2nd A wide.

Abdomen with basal tergites black, the succeeding ones more bicolored, black, with narrow, obscure yellow borders; outer segments and hypopygium more uniformly blackened. Male hypopygium much as in *heteropoda* but differing in all details. Basistyle with a narrowly blackened flange on its face. Outer dististyle broader, the apical spine short. Inner dististyle very simple in structure, merely bilobed instead of the trilobed condition in *heteropoda*; outer lobe a simple rounded head provided with a few powerful setæ. Ædeagus with the outer portion obtusely rounded.

Hab. Peru (Junin).

Holotype, ♂, Satipo; Jauja, altitude 800–900 metres, April 8, 1941 (*Paprzycki*).

The most similar described species is *Teucholabis* (*Paratropesa*) *heteropoda* Alexander, likewise from Peru, but from much higher altitudes in the Andes. This latter fly differs conspicuously in the coloration of the legs and wings, in the venation, and in the details of structure of the male hypopygium.

Teucholabis (*Paratropesa*) *paracollaris*, sp. n.

Belongs to the *collaris* group, allied to *neocollaris*; size large (wing, male, over 7 mm.); all femora differently patterned; wings relatively narrow, conspicuously marked with brown, including three more or less complete bands, the last occupying the wing-apex; abdomen with the more proximal segments bicoloured, purplish black with yellow apices, the outer segments, including the hypopygium, more uniformly blackened; male hypopygium with the apical spine of the basistyle stout, with its terminal point directed laterad; outer dististyle slender throughout, with about nine strong setæ; inner dististyle with its outer lobe unusually slender, with about six strong setæ that are restricted to the distal third; outer cephalic angle of inner blade strongly produced into a spine.

Male.—Length about 8 mm.; wing 7.2 mm.

Rostrum testaceous yellow; palpi brown. Front and anterior vertex testaceous yellow; palpi brown. Front

and anterior vertex testaceous yellow, the posterior portion of head uniformly polished black; anterior vertex broad, approximately six times the diameter of scape.

Pronotal scutum and cervical region light yellow, the scutellum black. Mesonotum uniformly polished black, with greenish reflexions; pleura almost uniformly black, variegated by restricted silvery pruinose areas above the mid-coxæ and on the metapleura; dorsopleural membrane buffy yellow. Halteres with stem blackened, knob abruptly pale yellow. Legs with the fore and middle coxæ pale yellow, the posterior coxæ and trochanters purplish black; remaining trochanters deep yellow; fore legs black, the femoral bases obscure brownish yellow, including about the proximal fourth; middle femora obscure yellow, the remainder of this leg broken; posterior femora bicoloured, black at either end, the central portion yellow, involving about two-fifths the total length of segment; remainder of posterior legs black; fore femora conspicuously clavate, more so than the posterior pair, with unusually long and abundant black setæ. Wings relatively narrow, whitish subhyaline, conspicuously patterned with brown, including three more or less complete bands; basal band incomplete, covering *h* and arculus, thence expanding into the subbasal portions of cells *Cu* and 1st *A*; second band complete, beginning at the darker triangular stigma, crossing the wing to the end of vein 1st *A*, lying almost entirely basad of cord, widest at mid-length; third band including the entire broad apex, extending basad almost to outer end of cell 1st *M*₂, the inner ends of cells *R*₅ to *M*₃ restrictedly brightened; veins brown, paler near extreme wing base. Venation: *Sc*₁ ending just beyond origin of *Rs*; *R*₂ immediately before level of basal section of *R*₅; vein *R*₃ suberect; vein *R*₅ extensively fused with *M*₁₊₂, as in the *collaris* group; *m-cu* shortly before fork of *M*.

Abdominal tergites purplish black, the more proximal segments ringed with yellow on posterior borders, the outer segments, including hypopygium, uniformly blackened; the more proximal sternites with the incisures even more extensively yellow. Sternal pocket on segment five very conspicuously developed, with blackened lobes in addition to the usual setæ. Male hypopygium with general structure of *neocollaris* but with important

differences. Spine at apex of basistyle very stout at base, the small acute apex directed laterad into a spine: in *neocollaris* the spine slender throughout, erect. Outer dististyle long and slender, simple, the tip an elongate spine; surface of style with about nine strong setae, the most proximad almost at base of style; in *neocollaris* the style much more dilated on basal half, the major setae fewer, about six in number. Inner dististyle with the outer lobe even more slender, pale, with about six strong setae that are restricted to the outer third or nearly so; inner blade with its cephalic angle with about eight setae that occupy the outer two-thirds; inner blade with the cephalic angle less produced.

Hab. Peru (Junin).

Holotype, ♂, Satipo, Jauja, altitude 800–900 metres, January 1943 (*Paprzycki*).

The nearest described ally of the present fly is *Teucholabis* (*Paratropesa*) *neocollaris* Alexander, which differs in the smaller size and, especially, in the structure of the male hypopygium, as compared above.

Gonomyia (*Lipophleps*) *mythica*, sp. n.

Belongs to the *manca* group; general coloration of mesonotum dark brown; thoracic pleura striped longitudinally with brown and yellow; *Sc*₁ ending opposite origin of *Rs*, the latter long, approximately six-sevenths as long as its anterior branch; male hypopygium with the paired elements symmetrical; outer lobe of basistyle small; dististyle bilobed, the outer arm bispinous; inner arm with its outer surface densely set with microscopic spiculæ; phallosome consisting of outer blackened rods that are incurved to the mid-line.

Male.—Length about 3 mm.; wing 3 mm.

Head broken.

Pronotum and pretergites chiefly pale yellow. Mesonotum chiefly dark brown, the region of the scutellum destroyed. Pleura striped longitudinally with brown and yellow. Halteres broken. Legs beyond the trochanters uniformly dark brown. Wings with a weak brownish tinge, the prearcular and costal fields clear light yellow; stigma scarcely indicated as a pale brown cloud; veins brown, more brownish yellow in the luteous fields. Venation: *Sc*₁ ending opposite the origin of *Rs*, *Sc*₂ a short

distance from its tip; *Rs* relatively long, approximately six-sevenths as long as its anterior branch; cell 1st M_2 a little shorter than vein M_4 beyond it; *m-cu* close to the fork of *M*; cell 2nd *A* wide.

Abdomen dark brown, patterned with yellow; hypopygium chiefly yellow, the basistyles weakly infuscated on their proximal halves. Male hypopygium (fig. 3) with the outer lateral lobe of basistyle, *b*, unusually small, subequal in size to the mesal lobule of the dististyle, provided with long setæ. Dististyle, *d*, alike on the two sides, of distinctive conformation, the outer lobe sinuous, blackened, narrowed to a slender spinous point, before apex with an even longer and more slender recurved spine; mesal lobe with a single fasciculate or enlarged seta; outer surface of lobule with rows of microscopic spicules, forming a dense covering over the entire surface. Phallosome, *p*, symmetrical, consisting of two outer blackened rods that are incurved and decussate at mid-line; a central pair of flattened blades that jut caudad beyond the other elements of the phallosome.

Hab. Peru (Junin).

Holotype, ♂, Satipo, Jauja, altitude 800–900 metres, March 21, 1941 (*Paprzycki*).

In its symmetrical hypopygium, the present fly suggests species such as *Gonomyia* (*Lipophleps*) *extensa* Alexander and numerous others. The shape and structure of the dististyle is distinctive of the present fly. Other species of the group having a bispinous dististyle, such as *G. (L.) ramus* Alexander and *G. (L.) vindex* Alexander, have the phallosome asymmetrical and with all other structures of the hypopygium quite distinct.

Gonomyia (*Lipophleps*) *philomela*, sp. n.

Belongs to the *manca* group; general coloration of thorax pale brown, the pleura more testaceous brown, unpatterned; legs brown; wings with Sc_1 ending shortly before origin of *Rs*, cell 1st M_2 shorter than vein M_4 beyond it; male hypopygium with the dististyles of the two sides asymmetrical, one with a large erect inner spine, the other with this spine reduced to a small cone; phallosome asymmetrical, terminating in three points, all of which are acute at tips.

Male.—Length about 3.5 mm. ; wing 3.5 mm.

Rostrum obscure yellow ; palpi black. Antennæ black ; flagellar segments elongate, with the usual very long verticils of the male sex in this subgenus. Head brown, somewhat brighter on the anterior vertex.

Pronotum pale brown ; pretergites restrictedly pale yellow. Mesonotum almost uniformly pale brown, the posterior border of scutellum broadly paler. Pleura pale testaceous brown, unstriped. Halteres infuscated. Legs with coxæ and trochanters obscure yellow, the fore coxæ a little darker ; remainder of legs uniformly brown. Wings with a brownish tinge, the prearcular and costal portions light yellow ; stigma large but barely indicated ; veins brown. Venation : Sc_1 ending shortly before origin of Rs , the latter about three-fifths as long as its anterior branch ; cell 1st M_2 narrow, shorter than vein M_4 beyond it ; *m-cu* close to the fork of M .

Abdominal tergites brown, sternites paler ; hypopygium brownish yellow. Male hypopygium (fig. 6) with the dististyles and phallosome asymmetrical. Outer lobe of basistyle, *b*, elongate, extending caudad about to the outer level of the dististyles. Armature of the dististyles of the two sides quite distinct, one, *d*, having the apex of the terminal spine directed basad and with the inner spine very long and powerful, much exceeding in length the outer spine ; the opposite style, *d*, has the outer spine a curved hook that is directed outwardly, the inner spine reduced to a small blackened elongate-conical structure, both dististyles terminating in a small obtuse knob with a single very powerful fasciculate seta near the margin, just back from the apex on the lower edge. Phallosome, *p*, terminating in three points, of which two are blackened, both ending in acute spines ; third arm directed caudad, paler, terminating in a long pale acute point.

Hab. Peru (Junin).

Holotype, ♂, Satipo, Jauja, altitude 800–900 metres, December 10, 1914 (*Paprzycki*).

This is the first regional member of the subgenus to be discovered in which the dististyles are unlike on the two sides of the body. Various other species showing this condition are found elsewhere in Tropical America, including *Gonomyia* (*Lipophleps*) *carrerai* Alexander, of south-eastern Brazil, and *G. (L.) macewaini* Alexander, of north-

ern Panama and southern Costa Rica, but all of these are quite different from the present fly.

Gonomyia (Lipophleps) dotata, sp. n.

Belongs to the *manca* group; general coloration of mesonotum dark brownish grey; thoracic pleura striped longitudinally with brown and silvery white; antennæ (male) relatively long, the flagellar segments with unusually abundant long erect setæ; wings with a brownish tinge, the prearcular and costal fields light yellow; male hypopygium with the outer lobe of basistyle elongate, fleshy; dististyle a single, powerful, nearly straight black spine from a dilated pale base; phallosome consisting of two short blackened spines and two elongate pale blades, both of the latter obtuse at tips, the longer ones very broadly so.

Male.—Length about 3.8 mm.; wing 4 mm.

Rostrum testaceous yellow; palpi black. Antennæ black throughout, unusually long for a member of the group; flagellar segments long-cylindrical, with very abundant long erect setæ that are nearly as long as the segments and are scattered over their entire length; a few still longer scattered setæ that are longer than the segments. Head obscure yellow in front, more infuscated behind.

Pronotum above and the pretergites whitish yellow, the sides of the former infuscated. Mesonotal præscutum and scutal lobes dark brownish grey, the central portion of scutum and posterior borders of the scutal lobes obscure yellow; scutellum infuscated medially at base, broadly obscure yellow on margin; mediotergite pale brown, extensively yellow on sides. Pleura pale brown, with a conspicuous silvery-white longitudinal stripe extending from behind the fore coxæ across the dorsal sternopleurite, ventral pteropleurite and meral region to the abdomen; dorsal pleurites more strongly darkened, the dorsopleural membrane yellow. Halteres weakly infuscated, knobs obscure yellow. Legs with the coxæ and trochanters obscure brownish yellow; remainder of legs dark brown. Wings with a brownish tinge, the prearcular and costal fields light yellow; stigmal region very weakly darkened; veins brown, including those in the brightened fields, only those at base a trifle brighter. Venation: *Sc*, ending immediately before origin of *Rs*,

Sc_2 some distance from its tip; Rs nearly three-fourths as long as its anterior branch; cell 1st M_2 small, M_{3+4} varying from only a little more than one-half to about three-fifths M_4 ; $m-cu$ about one-fourth its length before fork of M .

Abdominal tergites obscure brownish yellow, more darkened on sides; sternites clearer yellow. Male hypopygium (fig. 4) with the outer lobe of basistyle, b , elongate, extended caudad beyond the extreme tip of the dististyle and only a little shorter than the length of the basistyle itself. Dististyle, d , a single powerful, nearly straight black spine from the dilated pale base, the latter bearing a single enlarged seta and a slightly smaller one, additional to the normal bristles; on lateral face of style opposite the fasciculate setæ a strong conical point or spine; inner face at base of spine with a small area of erect setæ. Phallosome, p , consisting of two small blackened spines and two much longer, pale blades, both of the latter obtuse at their tips; one of the spines longer and more curved than the other, one of the pale blades longer and broader than the second, its apex very obtuse.

Hab. Peru (Junin).

Holotype, ♂, Satipo, Jauja, altitude 800–900 metres, December 20, 1940 (*Paprzycki*).

Very different from other regional members of the *manca* group. The nearest relative appears to be *Gonomyia* (*Lipophleps*) *petronis* Alexander, of south-eastern Brazil, which has the antennæ of the male very much the same and with somewhat similar basic features of the male hypopygium, but with all details quite different.

Gonomyia (*Lipophleps*) *scelerata*, sp. n.

Belongs to the *manca* group; general coloration of the mesonotum medium brown; thoracic pleura with a whitish longitudinal stripe; wings with a weak brownish tinge; Sc_1 ending a short distance before origin of Rs ; male hypopygium with the dististyle fleshy, apical in position, the entire outer surface with abundant erect setulæ additional to the two fasciculate setæ and sparse normal bristles; phallosome large, terminating in two acute blackened points, one a slender curved sickle and a short pale blade.

Male.—Length about 3 mm.; wing 3.2 mm.

Rostrum and palpi black. Antennæ with the scape and pedicel brown, flagellum passing into black; subbasal flagellar segments with unusually long verticils. Head yellow on anterior vertex, grey behind; eyes large.

Pronotum above and the pretergites whitish. Mesonotum medium brown, pleurotergite paler. Pleura of the unique type crushed, evidently pale with a moderately conspicuous yellowish white longitudinal stripe. Halteres with stem pale, knob weakly infuscated. Legs with the coxæ and trochanters yellow; remainder of legs broken. Wings with a weak brownish tinge, the prearcular and costal fields pale yellow; stigma faintly darker, its margins very poorly delimited; veins brown, paler in the more brightened fields. Venation: Sc_1 ending a distance before origin of R_s equal to more than one-third the length of the latter; anterior branch of R_s strongly upcurved, on its outer portion nearly parallel to R_1 ; cell 1st M_2 pointed at its inner end; $m-cu$ at fork of M .

Abdominal tergites brown, sternites more yellowish; hypopygium brownish yellow. Male hypopygium (fig. 5) with the basistyle, b , long and slender, the single dististyle, d , apical in position, fleshy; vestiture of dististyle, additional to the two enlarged or fasciculate setæ, including about six or seven weaker bristles from conspicuous punctures; entire outer surface of style with abundant erect setulæ from very inconspicuous punctures. Phallosome, p , a large, compact, central mass that terminates in two acute points and a short flattened pale blade; longest element a strong curved glabrous sickle, its long acute tip blackened; second spine much shorter, the outer margin with abundant delicate setulæ; pale blade obtuse at tip.

Hab. Peru (Junin).

Holotype, ♂, Satipo, Jauja, altitude 800–900 metres, March 1, 1941 (*Paprzycki*).

Although superficially resembling species allied to *Gonomyia* (*Lipophleps*) *inermis* Alexander, the present fly is quite distinct in all details of structure of the male hypopygium. The presence of abundant delicate setulæ on the outer face of the dististyle is a noteworthy feature.

Neognophomyia sparsiseta, sp. n.

General coloration of mesonotum reddish yellow, clearer yellow behind; a broad black dorsal longitudinal stripe on thoracic pleura; antennal flagellum dark brown; legs yellow, the tips of the tibiæ and basitarsi darkened, the fore basitarsi uniformly so; wings subhyaline, with a narrow brown band extending from the stigma over the anterior cord; cell R_2 at margin very narrow; male hypopygium with the tergal spines pale, gently twisted, the narrow spinous tips about one-half as long as the more expanded basal blades; both dististyles unusually simple in conformation, the outer one with three setæ of which one is apical in position; inner style slender, narrowed gradually to a blackened subacute point, the outer surface with unusually few setæ.

Male.—Length about 5.5 mm.; wing 5.2 mm.

Rostrum and palpi yellow, the outer two segments of the latter slightly infuscated. Antennæ with the scape yellow, pedicel brownish yellow, flagellum dark brown; verticils long and conspicuous, especially on the basal and intermediate flagellar segments. Head yellow.

Pronotum yellow above, more infuscated on sides. Mesonotal præscutum chiefly reddish yellow, the posterior sclerites of notum clearer yellow; most of the notum with a microscopic appressed white pruinosity. Pleura with the dorsal portion occupied by a broad black longitudinal stripe extending from the propleura to the base of abdomen, including much of the pleurotergite, very narrowly interrupted at the sutures between the various segments; ventral pleurites more reddish yellow, the meron pale yellow. Halteres with stem yellow, knob infuscated. Legs with coxæ and trochanters pale yellow; femora uniformly yellow; tibiæ and basitarsi yellow, the tips narrowly but conspicuously dark brown; remainder of tarsi brownish black; fore legs with the tarsi uniformly blackened. Wings subhyaline, the extreme base more yellowed; a narrow brown band extending from the stigma across the anterior cord; on the posterior cord and outer end of cell 1st M_2 much narrower and less conspicuous; veins brown, darker in the patterned areas, in the prearcular field more yellowed. Venation: R_{2+3+4} subequal to R_{3+4} ; vein R_3 short, cell R_2 at margin very narrow, cell R_3 correspondingly wider; $m-cu$ about its own length beyond the fork M .

Basal abdominal tergites yellow medially, darker laterally, the intermediate segments more uniformly darkened, the outer ones again bicoloured, pale basally, with a darkened subterminal band; eighth segment reduced in size, pale; sternites chiefly yellow; hypopygium brownish yellow. Male hypopygium with the tergal spines pale, appearing as moderately long, gently twisted blades, the tips gradually narrowed into acute points that are only about one-half as long as the expanded portions. Both dististyles unusually simple in conformation, provided with very few setæ. Outer dististyle with three such setæ, one apical in position; inner style unusually slender, narrowed gradually to a blackened subacute point, the outer surface with only three major setæ and a few additional paler ones. Phallosome narrow, obtusely rounded at the blackened tip.

Hab. Peru (Junin).

Holotype, ♂, Satipo, Jauja, altitude 800–900 metres, July 17, 1940 (*Paprzycki*).

The most similar described species is *Neognophomyia hostica* Alexander, which differs particularly in the structure of the male hypopygium, particularly the shape and vestiture of the two dististyles.

Neognophomyia citripes, sp. n.

General coloration orange or fulvous, the mesothorax polished, variegated only by a large oval black spot on the pleurotergite; knobs of halteres brownish black; legs deep orange, the tarsi and tips of tibiæ blackened; wings relatively narrow, about three-and-one-half times as long as wide, tinged with brown and with a narrow, darker brown cross-band at the cord; *Rs* short, subequal to *R*; *R*₂₊₃₊₄ very short, *R*₂ in alignment with *r-m*; abdomen orange, the tergites with narrow black rings at base of segment two and at the incisure between segments four and five.

Female.—Length about 6.5 mm.; wing 5.7×1.6 mm.

Rostrum and palpi brown. Antennæ with scape and pedicel obscure yellow, flagellum black; flagellar segments elongate-oval to subcylindrical, with very long, conspicuous verticils. Front and anterior vertex brownish yellow, the posterior vertex darker brown; anterior vertex narrow, less than the diameter of scape, the eyes correspondingly large.

Pronotum yellow. Mesonotum and pleura deep fulvous yellow, the surface polished, the humeral and lateral borders of præscutum narrowly yellow; pleurotergite concolorous, with a large oval black spot occupying much of the sclerite; remainder of thorax quite unmarked. Halteres with stem yellow, knob brownish black. Legs with the coxæ and trochanters fulvous; femora and tibiæ deep orange, the tips of the latter brownish black, the tarsi passing into black. Wings relatively narrow, as shown by the measurements; ground-colour rather strongly infuscated; prearcular field very restricted in area, more or less darkened; costal border a little more yellowed; a narrow brown band at cord; outer end of cell 1st M_2 less evidently darkened; veins brown, still darker along cord, more yellowed in the prearcular and costal fields. Venation: R_s unusually short, subequal in length to that portion of vein R beyond the arculus; R_{2+3+4} very short, only about one-half the basal section of R_5 ; R_2 in direct alignment with $r-m$; R_{3+4} a little shorter than R_3 , R_4 ending close to wing-tip; cell 1st M_2 widened outwardly, basal section of M_3 angulated beyond mid-length; $m-cu$ approximately two-thirds its length beyond fork of M ; vein 2nd A moderately long, the distal half straight, the end of the cell pointed.

Abdomen obscure orange, yellow pollinose, the tergites with an unusually restricted pattern of black, including a narrow transverse band at extreme base of second tergite and a broader band involving the posterior border of tergite four and base of tergite five; cerci compressed-flattened, yellow.

Hab. Peru (Loreto).

Holotype. ♀, Iquitos, March–April 1921 (Shannon).

Neognophomyia citripes is most similar to *N. bisecta* (Alexander), likewise from the Amazonian region, differing most evidently in the coloration of the body, legs and wings, and in the narrow wings with distinctive venation, especially the short R_s and position of R_2 .

Erioptera (Erioptera) susurra, sp. n.

Size very small (wing, male, 2.5 mm.); general coloration of thorax yellow, the dorsum slightly infuscated medially, the pleura weakly pruinose; legs slightly darkened; wings greyish yellow, unpatterned;

male hypopygium with the outer dististyle profoundly branched beyond base, the outer arm a strong curved rod that bears a slender erect spine on its lower margin beyond base; gonapophyses appearing as long, decussate rods, the tips produced into long-extended spines, with abundant spinulose points on lower face back from tip.

Male.—Length about 2.2 mm.; wing 2.5 mm.

Head broken.

Thorax above chiefly obscure yellow, the mid-dorsal portion weakly infuscated. Pleura obscure yellow, with a weak grey pruinosity. Halteres with stem pale, the knob a trifle infuscated. Legs with the coxæ pale yellow, the fore pair a trifle darker; trochanters obscure yellow; remainder of legs weakly darkened, the colour produced chiefly by abundant dark-coloured setæ. Wings greyish yellow, without pattern; veins brownish yellow; macrotrichia dark brown. Venation: Sc_1 ending shortly before level of fork of R_s , Sc_2 about opposite one-fifths the length of the latter; $r-m$ and $m-cu$ almost in transverse alignment, the latter about one-third its length beyond the fork of M ; tip of vein Cu_1 deflected slightly cephalad; vein 2nd A gently sinuous, ending about opposite one-fourths the length of R_s .

Abdominal tergite pale brown, sternites yellow; hypopygium brownish yellow. Male hypopygium with the complex outer dististyle profoundly branched shortly beyond base, one branch appearing as a straight dusky rod that narrows to the obtuse tip; second arm a much stronger and more powerful curved rod that narrows gradually to the pointed blackened tip; on lower face of this arm, shortly beyond base, with a slender erect spine; distal third of arm, including all of the blackened portion, with microscopic roughened points. Inner dististyle a shorter pale flattened blade, weakly sinuous and very gently curved, its tip with microscopic punctures. Gonapophyses appearing as long powerful rods that near their tips are decussate across the mid-line, each longer than either of the dististyles, narrowed to the long-extended acute tips; distal third of lower face with abundant appressed spinulose points.

Hab. Peru (Junin).

Holotype, ♂, Satipo, Jauja, altitude 800–900 metres, January 6, 1941 (*Paprzycki*).

The most similar described species is (*Erioptera micromyia* Alexander, which differs in the entirely different male hypopygium.

Erioptera (Mesocyphona) histrio, sp. n.

General coloration pale yellow; thoracic pleura with two narrow brown longitudinal stripes, each only about one-third as wide as the yellow enclosed area; apex of knob of halteres infuscated; fore and middle coxæ infuscated, posterior pair yellow; remainder of legs yellow, the femora with a pale brown subterminal ring; wings whitish yellow, patterned with darker brown spots and pale brown washes in many of the cells, to produce a conspicuously variegated appearance; Sc_2 ending about opposite mid-length of R_s ; abdomen yellow, with a narrow brown lateral stripe.

Female.—Length about 3.3–3.2 mm.; wing 3.2–3.5 mm.

Rostrum brownish yellow; palpi black. Antennæ medium brown; flagellar segments oval, the verticils long and conspicuous. Head obscure yellow, darker on the more ventral portions.

Pronotum yellow. Mesonotum yellow, the præscutum with an intermediate pair of pale brown stripes, more clearly indicated near the suture. Pleura pale yellow, with two narrow, longitudinal, pale brown stripes, the more dorsal including the fore coxæ, ending beneath the wing-root; ventral stripe including the mid-coxæ, reaching the base of abdomen; dark stripes only about one-third as wide as the enclosed yellow area. Halteres with stem yellow, apex of knob infuscated. Legs with the fore and middle coxæ darkened, as above described, posterior coxæ uniformly pale yellow; femora brownish yellow, clearer yellow basally and as narrow apical and subapical rings, the two latter enclosing a slightly broader pale brown annulus; remainder of legs pale yellow; femora with long darkened setæ. Wings whitish yellow, conspicuously patterned with brown; spots and paler brown washes in most of the cells; the darker areas include the origin of R_s , Sc_2 , cord, fork of M_{1+2} , and a marginal series, lacking at tips of veins R_4 , M_{1+2} and 1st A , more extensively seamed back from margin on veins R_5 , Cu_1 and 2nd A ; the dark area at tip of vein R_3 crosses cells R_3 and R_4 , becoming confluent with the seam on R_5 and

thus forming a short cross-band; the pale brown washes include much of the outer medial field and all cells of basal third of wing; veins yellow, darker in the more heavily infuscated fields; macrotrichia long and conspicuous. Venation: Sc_2 about opposite mid-length of R_3 ; R_{2+3+4} only a little longer than the basal section of R_5 ; tips of outer medial veins bent slightly caudad, of Cu_1 very slightly cephalad; $m-cu$ nearly transverse, approximately one-half its length before fork of M .

Abdominal tergites obscure yellow, the sternites clearer yellow; a narrow dark brown lateral stripe.

Hab. Peru, southern Ecuador.

Holotype, ♀, Satipo, Jauja, Junin, Peru, altitude 800–900 metres, December 4, 1940 (*Paprzycki*). *Paratype*, ♀, Zumbi, Rio Zamora, Santiago-Zamora, Ecuador, altitude 700 metres, October 30, 1941 (*David Laddey*).

The present fly is very distinct from all other regional members of the subgenus, differing particularly in the coloration of the body and wings. There is no species with which the fly may profitably be compared.

Styringomyia mystica, sp. n.

General coloration pale yellow, the mesonotum more reddish yellow, sparsely pruinose; wings pale yellow, with a small brown cloud over $r-m$ and adjoining veins; male hypopygium with the apical lobe of basistyle narrowed outwardly, terminating in two powerful flattened black setæ, with a third strongly sinuous bristle more basad; dististyle complex in structure.

Male.—Length about 7.5–8 mm.; wing 5 mm.

Female.—Length about 6 mm.; wing 4.5 mm.

Rostrum brownish yellow; proximal segments of palpi obscure yellow, the outer segments more infuscated, with narrow pale bases. Antennæ with scape yellow above, more infuscated beneath; pedicel infuscated; flagellum chiefly pale yellow, appearing weakly bicoloured because of the ring of basal verticils. Head pale yellow, the centre of vertex weakly darkened; vertical setæ black, conspicuous, but not modified.

Pronotum pale medially, sparsely pruinose. Mesonotum chiefly pale reddish yellow, slightly pruinose, with a more or less distinct more testaceous median stripe over.

much of the notum; setæ black, erect, unmodified. Pleura pale testaceous yellow throughout. Halteres yellow. Legs with the coxæ and trochanters pale yellow: remainder of legs yellow, the fore femora with a narrow subterminal pale brown ring and vague indications of one or two other annuli more proximad in position; middle femora likewise with a narrow subterminal ring, posterior femora uniformly yellow; remainder of legs chiefly yellow, the terminal tarsal segments blackened. Wings pale yellow, with a small brown cloud over $r-m$; veins yellow, $r-m$ and adjacent veins in the darkened area infuscated. Venation: Cell 2nd M_2 sessile to short-petiolate; vein 2nd A simple.

Abdomen with tergites obscure yellow, their caudal borders narrowly ringed with brown, the basal annuli of the outer segments with a paler brown central triangle, wider posteriorly; sternites and hypopygium clearer yellow. Male hypopygium (fig. 7) with the lobe of basistyle, b , narrowed outwardly, terminating in two powerful flattened black setæ; mesal edge of lobe with a further smaller, very strongly sinuous bristle. Dististyle, d , of unusual conformation, approximately as illustrated; at base on outer margin bearing a blackened clavate lobe provided with a single powerful spinous bristle; remainder of style narrowed basally, thence expanded into a relatively narrow spatulate blade that terminates in two blackened points, the more basal a slender straight rod; outer margin of blade before apex with a small lobe that terminates in a very strong, powerful seta; remainder of blade with scattered setæ, the two on the inner margin stronger than the group of about a dozen on lateral portion of style. Ovipositor with apex of cercus slightly longer and more attenuated than in *dorsolineata*, its tip truncate.

Hab. Peru (Junin).

Holotype, ♂, Satipo, Jauja, altitude 800–900 metres, February 5, 1940 (*Paprzycki*). *Allotopotype*, ♀, pinned with type. *Paratopotypes*, 4 ♂♀, July 17–29, 1940 (*Paprzycki*).

Styringomyia mystica is quite distinct from all other Neotropical members of the genus so far discovered. As is usual in this genus, the chief specific characters lie in

the structure of the male hypopygium, particularly of the basistyle and dististyle.

Styringomyia simplex, sp. n.

General coloration yellow, patterned with brown; mesonotum extensively infuscated, its central portion obscure yellow; legs yellow, the fore and middle femora with a narrow brown subterminal ring, the posterior legs uniformly yellow; wings relatively long and narrow, the medial fields and adjoining veins infuscated, especially the veins; basal third of wing with costal fringe of male long and conspicuous; abdominal tergites with the posterior borders broadly infuscated, more extensively so on the outer segments; male hypopygium with basistyle narrowed at apex, bearing three or four strong black setæ; dististyle simple, more or less resembling the head and beak of a bird.

Male.—Length about 7–8 mm.; wing 4.5–5 mm.

Female.—Length about 5 mm.; wing 4 mm.

Rostrum and palpi brown. Antennæ with the more proximal segments weakly infuscated, the outer ones passing into clearer yellow; flagellar segments oval, the outer ones more elongated. Head above light brown, more brownish yellow on sides; setæ of head black, long but not modified.

Pronotum dark brown, the median portion very restrictedly paler. Mesonotum chiefly dark brown, the central portion, including the posterior half of præscutum, central area of scutum, including part of the lobes and the median region of scutellum, obscure yellow, the remainder of scutal lobes and most of the scutellum brownish black; postnotum infuscated; setæ of thoracic notum erect, black, long and conspicuous but not modified. Pleura and pleurotergite uniformly yellow. Halteres yellow. Legs with the coxæ and trochanters yellow; femora yellow, the fore and middle pairs with a narrow brown subterminal ring, posterior femora uniformly yellow; tibiæ yellow, slightly more darkened at tips; posterior tibiæ more uniformly yellow; tarsi yellow, the terminal segment of anterior legs weakly darkened. Wings relatively long and narrow, yellow, the prearcular field clearer yellow; a brown seam over $r-m$; medial

veins beyond cord, R_3 and $m-cu$ all vaguely bordered by brown, best indicated by a darkening of the otherwise yellow veins; Cu and bases of anal veins less evidently darkened. Costal fringe on basal third of wing long and conspicuous, much shorter on the outer portion. Venation: Vein R_3 oblique; $r-m$ subequal to R_{3+3+4} ; cell 1st M_2 long and narrow, widened outwardly; cell 2nd M_2 barely sessile; $m-cu$ about one-and-one-half times its own length beyond the fork of M ; vein 2nd A simple.

Abdominal tergites bicoloured, the bases of the segments obscure yellow, the apices broadly infuscated, more extensively so on the outer segments; sternites yellow, weakly patterned with pale brown; hypopygium brownish yellow. Male hypopygium (fig. 9) quite different in construction from that of *americana*. Basistyle, b , narrowed distally into a short, relatively slender lobe that bears three or four long black powerful setæ, additional to the normal ones. Dististyle, d , simple, a generally long oval blade that narrows to a blackened spinous apical point; on face of style near apex with a small black spine, better indicated in the paratypes; before apex, style with about nine or ten long setæ on one face, together with about two smaller setæ, with a third more basal one of great length, on the opposite face; outer margin of style with a few scattered additional setæ, the entire style more or less resembling the head and beak of a bird.

Hab. British Guiana, Peru.

Holotype, ♂, Bartica, British Guiana, January 28, 1913 (*Parish*); confused in collections with *americana*. *Allotype*, ♀, Satipo, Jauja, Junin, Peru, altitude 800-900 metres, November 10, 1940 (*Paprzycki*). *Paratypes*, 2 ♂♂, 1 ♀, with the allotype, November 10, 1940-April 5, 1941 (*Paprzycki*).

Styringomyia simplex is entirely distinct from *S. americana* Alexander, with which it had been confused in collections. The latter species has a very extensive range in Central and northern South America, as now known including British Honduras, Costa Rica, Colombia, Venezuela, British Guiana, Surinam and north-western Ecuador. I am illustrating the male hypopygium (fig. 8), not previously figured.

XXIV.—On a Small Collection of Ants (*Hym.*, Formicidæ) from West Africa, associated with Coccidæ. By HORACE DONISTHORPE, F.Z.S., F.R.E.S., etc.

Family Formicidæ.

Subfamily MYRMICINÆ.

Crematogaster (*Sphærocrema*) *boxi* Donisthorpe, 1945, Entomologist, lxxviii. p. 10.

No. H.1361. Eight workers taken by Mr. H. E. Box with a *Pseudococcus* sp. in pods of *Sterculia tomentosa*. Gold Coast, N. Ashanti, 20 miles north of Wenchi, May 5, 1944.

Crematogaster (*Sphærocrema*) *striatula* Emery, 1892, Ann. Soc. Ent. France Bull. lxi. p. 53.

No. H.1367. With *Pseudococcus* sp. ?, on swollen shoots of infected Cacao. Near Abengourou, Ivory Coast, May 18, 1944. No. H.1350, with *Pseudococcus* ? *exitabilis* on unknown liane (*Clerodendron* sp. ?). Gold Coast, May 2, 1944. No. H.1380, on Cacao (pod). British Togo, Lekleki Dafo, Nov. 4, 1944. No. H.1381, on *Coffea excelsa* (cultivated, berry pedicels and leaf axils). British Togo, Lekleki, Dafo, Nov. 4, 1944. No. H.1375, on Cacao (pod). British Togo, Bame Pass (800 ft. alt.), Nov. 2, 1944. No. H.1405, on Cacao. Gold Coast, Nkawkaw, Nov. 23, 1944, taken by Mr. J. Paine. No. H.1411, on Cacao. Gold Coast, Bawdua, nr. Kade (Centr. Prov.), Dec. 2, 1944, K. O. Darko collection. No. H.1425, on *Strombosia pustulata* (*Olacaceæ*). Young sapling, in prim. forest, Gold Coast, Bunsu, 750 ft., Jan. 1, 1945. No. H.1435, on *Voacanga africana* (*Apocynaceæ*). First record on a lacticiferous plant: Gold Coast, Pimpinso, near Begoro, Jan. 9, 1945.

All the above were taken by Mr. H. E. Box, except where otherwise stated.

The data concerning the different plants are of importance in connection with the Coccidæ found on them; the ants having simply sought out the scale-insects on them.

Crematogaster (*Sphærocrema*) *fulva*, sp. n.

♀. Smooth and shining, light brownish yellow, club of antennæ slightly lighter, gaster piceous, especially towards

apex, teeth of mandibles and eyes black. Clothed with very short and sparse decumbent yellow hairs, more plentiful on gaster, and a few short erect yellow hairs.

Head subquadrate, cheeks and temples rounded, posterior angles round, posterior border excised in middle; *mandibles* triangular, longitudinally striate, *masticatory border* armed with four teeth, the two apical ones being longer and sharper; *clypeus* round and convex on disc, anterior border slightly rounded in middle and sinuate at sides, posterior border round with concave part of curve at base; *frontal area* indistinct; *frontal carinæ* moderate, sharp, slightly raised, slightly divergent posteriorly; *antennal foveæ* rounded externally, somewhat deep; *antennæ* 11-jointed, with a 3-jointed club, fairly long, *scape* narrow and curved at base, not reaching posterior border of head, *funiculus* with first joint longer than broad, longer and broader than the five following joints, which are transverse, sixth joint longer and slightly broader than the five preceding, second joint of club longer and broader than the first, last joint longer and broader than, but not quite as long as, the two preceding taken together; *eyes* round, oval, somewhat convex. *Thorax* longer than broad, broadest before middle, considerably contracted before epinotum, furnished with a neck; *pronotum* convex, anterior angles rounded but prominent, margined at sides; *pro-mesonotal suture* only visible at sides; *mesonotum* transverse if viewed from the side, convex above in continuation with the pronotum; *meso-epinotal suture* well marked; *sternites* of *meso-* and *metathorax* distinctly longitudinally striate; *epinotum* armed with two sharp rather strong teeth which project outwards and slightly downwards at apex, dorsal surface slightly convex, as long as declivity, which is concave; *petiole* broadest at base, narrowed to apex, flat on disc; *post-petiole* small, globular, convex, rounded above and at sides, narrower than petiole, without any furrow or impressions; *gaster* heart-shaped, fairly long, truncate at base, pointed at apex.

Long. 3.5 mm.

Type in B.M. (Nat. Hist.).

No. 1415. Described from 15 specimens taken by Mr. H. E. Box. Gold Coast, Ashanti, 11 miles east of Nkoranza (Ejura Rd.), 26. xii. 1944, on *Lophira alata* (*Ochnaceæ*) in parkland savannah.

Crematogaster (Acrocoelia) painei, sp. n.

♀. Smooth and shining, yellowish brown, club of antennæ dirty yellow; clothed with fine short decumbent yellow hairs.

Head subquadrate, about as long as broad, slightly narrowed anteriorly, rounded from eyes to posterior angles, which are round, posterior border slightly excised in middle; *mandibles* narrow, shining, armed with teeth, the apical one being the longest and sharpest; *clypeus* round and convex on disc, anterior border truncate, very slightly sinuate at sides; *frontal area* distinctly defined; *frontal furrow* extending to centre of head, enclosed in a shallow pit on disc; *cheeks* finely longitudinally striate; *frontal carinae* narrow, rather wide apart, slightly divergent posteriorly; *antennæ* 11-jointed, with a 3-jointed club, *scap* narrow, reaching posterior border of head, *funiculus* with first joint longer and broader than the six following joints, the second, sixth and seventh joints are longer than broad, the three joints of the club increase in length and breadth, the last joint not longer than the two preceding ones taken together; *eyes* fairly large, oval, somewhat prominent, situated about the centre of sides of head. *Thorax* longer than broad, contracted before epinotum; *neck* concave; *pronotum* smooth and shining, convex, margined in front and at sides, anterior angles and sides rounded; *pro-mesonotal suture* very faintly indicated; *meso-epinotal suture* deep and well marked; *mesonotum* somewhat longitudinally striate on dorsal surface; *episternite of mesothorax* closely but finely punctured; *epinotum* armed with two short sharp spines, projecting outwards, and slightly downwards at apex, space between spines flat, smooth and shining, no marked angle between dorsal surface and declivity. *Petiole* narrowed in front and behind, broadest about middle, flat, smooth, with a narrow transverse furrow before apex; *post-petiole* convex, rounded, about as broad as petiole in middle, with a longitudinal suture dividing dorsal surface into two spheres; *gaster* short, heart-shaped, pointed at apex.

Long. 2.8 mm.

Type in B.M. (Nat. Hist.) Coll.

Described from three specimens (No. H.1431) taken by Mr. J. Paine on *Ceiba pentandra* (Bombacaceæ). Young tree, Gold Coast, Koransang, Jan. 6, 1945.

These ants are smaller than any species of *Acrocœlia* in the B.M. Collection. It is always possible, however, that they belong to the first brood of a young *Crematogaster* queen.

Crematogaster (*Atopogyne*) *africana* Mayr, 1895, Ann. Naturh. Hofmus. Wien, x. p. 142.

No. H.1413, on *Cola*? *togoensis* in fringing forest in the savannah-forest belt, N. Ashanti, 6 miles north of Wenchi. Taken by Mr. H. E. Box, Dec. 25, 1944.

Crematogaster (*Atopogyne*) *cuvieræ* Donisthorpe, 1945, Entomologist, lxxviii. p. 10.

No. H.1023, taken by Mr. H. E. Box from myrmecodomatia on leaf petioles of *Cuviera acutiflora*. Gold Coast, Asuansi, Sept. 8, 1943. No. H.1403. In hollow stems (domatia) of young *Canthium glabriflorum* (*Rubiaceæ*) inhabited by this ant. Gold Coast, Bunsu, 750 ft., Nov. 22, 1944. Taken by Mr. H. E. Box.

Crematogaster (*Atopogyne*) *halli*, sp. n.

♀. Blackish brown, mandibles, sides of clypeus, cheeks anteriorly, apex of frontal carinæ, tarsi and articulations of legs reddish, extreme apex of last joint of club yellow (in some specimens the whole of the club is inclined to be reddish), clothed with short sparse decumbent yellow hairs.

Head subquadrate, narrower in front than behind, posterior angles rounded, posterior border excised in middle; *mandibles* triangular, stout, strongly longitudinally striate and punctured, masticatory border armed with four rather blunt teeth, the apical one being the longest and sharpest (in some specimens the teeth are all blunter, possibly from use); *clypeus* large, convex, anterior border truncate, slightly sinuate at sides, strongly longitudinally striate, the central stria forming a carina extending from apex to base, posterior bluntly pointed; *frontal area* triangular, well marked, deep; *frontal furrow* fine, narrow, reaching about the middle of head; *frontal carinæ* narrow, flat, fairly long; *antennal foveæ* rather wide but not deep; the whole head is finely, but distinctly longitudinally striate; *antennæ* 11-jointed with a 3-jointed club, *scape* narrow and slightly curved at base.

thickened to apex, just reaching posterior border of head, none of the joints of *funiculus* are transverse, the club is large and long, increasing in length and breadth, almost as long as rest of *funiculus*, the last joint is not quite as long as the two preceding taken together; *eyes* rather large, oval, somewhat flat, situated a little behind the centre of sides of head. *Thorax* thick-set, longer than broad, broadest a little behind anterior point of mesonotum, contracted before epinotum, the whole thorax is longitudinally striate; *pronotum* large, convex, prominent, disc submarginate, sides rounded and finely margined, neck flat, anterior angles rather prominent, the interstices of striæ on disc are also finely longitudinally striate; *mesonotum* raised, somewhat flat, slightly longer than broad, pointed anteriorly, the point raised and continued in a carina reaching beyond middle of mesonotum, sides rounded, base truncate, declivous, and transversely striate, the longitudinal striæ on disc are closer than those of the pronotum; *meso-epinotal suture* deep and rather wide; *epinotum* armed with two strong sharp spines, rather thick at base, and projecting outwards, *dorsal surface* shorter than declivity, with coarse longitudinal striæ, *declivity* concave, almost smooth in middle, transversely striate at sides. *Petiole* broader in front than behind, narrowed to apex, flat anteriorly, shining and very finely punctured; *post-petiole* globular, sides rounded, convex, broader than long, very finely punctured and with a very faint (hardly visible) impression * at apex; *gaster* heart-shaped, broad at base, pointed at apex, first segment very finely punctured and transversely striate, second segment more finely transversely striate.

Long. 3.8-4.8 mm.

Type in B.M. (Nat. Hist.) Coll.

This species is described in honour of Dr. W. J. Hall, who is working out the different species of Coccidæ (*Pseudococcus*, etc.) with which all the ants in this paper are associated.

* Emery's character "Postpétiole seulement impressionné en arrière" for the subgenus *Atopogyne* Forel, in his table of the subgenera of *Crematogaster*, is most unsatisfactory. In our specimens of *C. (Atopogyne) depressa* Latr., I am unable to see it at all. *Crematogaster halli* is a true *Atopogyne*; the pro-mesonotal suture is impressed, the mesonotum is carinate in front, and the foundation of the sculpture is densely striate.

Described from 24 workers (H.1426 A. and H.1426 B) taken by Mr. H. E. Box in hollow stems (domatia) of mature *Canthium glabriflorum* inhabited by these ants.

Gold Coast, Bunsu, Jan. 1, 1945.

This distinct species comes in the *C. (A.) depressa* Latr. group, to which *C. (A.) mottazi* Santschi, from the Ivory Coast, also belongs.

Crematogaster (Atopogyne) togoensis, sp. n.

♀. Black, somewhat shining, clothed with short decumbent yellow hairs and some outstanding longer yellow hairs; club of antennæ and tarsi dirty yellow; mandibles reddish at apex.

Head a little longer than broad, broadest before posterior angles, which are round, posterior border excised in middle; *mandibles* triangular, striate and punctate, masticatory border armed with four rather strong teeth, the apical one longest and sharpest; *clypeus* convex, anterior border rounded, slightly sinuate at sides, longitudinally striate, posterior border rounded; *frontal area* narrow, triangular, well defined, but shallow, longitudinally striate; *frontal furrow* fine, continued beyond centre of head, spaces on each side very finely longitudinally striate, rest of head slightly more strongly striate and faintly and fairly closely punctured; *frontal carinæ* narrow, flat, divergent posteriorly; *antennal foveæ* fairly large and deep; *antennæ* 11-jointed, *club* 3-jointed, *scape* not reaching posterior border of head, not much thickened to apex, *funiculus* with first joint broader, but shorter, than second, club increasing in length and breadth, last joint about as long as the two preceding taken together. *Thorax* rather short, longer than broad, contracted at meso-epinotal furrow, sides rounded anteriorly to furrow; *pronotum* finely longitudinally striate and punctate, the punctures on the sides are larger than on the disc and wider apart, disc (with mesonotum) submarginate, humeral angles rather prominent; *mesonotum* rather flat, very finely longitudinally striate and punctured, the striæ on sides being stronger, a strong *carina* extends from the pointed anterior margin to the declivity at base, posterior border declivous and transversely striate; *meso-epinotal furrow* wide and deep; *epinotum* armed with two rather stout short sharp spines,

projecting outwards, dorsal surface not as long as declivity, longitudinally striate, declivity somewhat concave, smooth and shining, transversely striate at sides; *post-petiole* broader than long, sides rounded, rather flat on disc, with a slight longitudinal impression posteriorly; *gaster* heart-shaped, first segment very finely and closely punctured, which gives a somewhat dull appearance, with larger (though quite small) punctures regularly scattered over it, second segment finely transversely striate and somewhat shining.

Long. 3-4 mm.

Type in B.M. (Nat. Hist.) Coll.

No. H.1385. Described from thirteen specimens taken by Mr. H. E. Box on *Cacao* (pod). French Togo, Mayondi (two miles east of Honuta, British Togo), Nov. 5, 1944.

Subfamily FORMICINÆ.

Camponotus (Myrmopiromis) flavosetosus, sp. n.

♂. Black, mandibles and legs brown, articulations of the legs, tarsi and funiculi lighter. Head and thorax dull, gaster shining, clothed with very sparse, yellowish pubescence and fairly long outstanding pointed golden-yellow hairs.

Head triangular, narrowed to apex, slightly rounded to posterior angles, which are round, considerably broader behind eyes than anteriorly, posterior border almost straight, the sculpture consists of very fine, close, somewhat reticulate puncturation; *mandibles* strong, triangular, with larger and smaller scattered punctures, masticatory border armed with five or six strong teeth, the apical one being long and sharp; *clypeus* large, convex, triangular, broadly but distinctly carinate, anterior border widely excised in middle, rather deeply sinuate before side-pieces, furnished with a row of rather uneven yellow bristles or hairs, the centre one being the longest; *frontal area* indistinct; *frontal furrow* fine and narrow, extending beyond the centre of the flat surface between the frontal carinæ; *frontal carinæ* long, sharp, raised, sinuate in front and behind, flat surface between, broadest behind middle; *antennæ* 12-jointed, *scape* narrow, slightly curved, broadest before apex, reaching a little beyond posterior border of head, *funiculus* with all

the joints longer than broad and increasing in length and slightly in breadth to apex, first joint shorter than second, last joint not as long as the two preceding taken together; *eyes* fairly large, oval, not very convex, situated above and behind centre of sides of head. *Thorax* longer than broad, narrowed to base, broadest a little behind centre of pronotum, viewed from the side forming a regular arch, sculpture similar to that of head; *pronotum* rounded at sides, narrowed anteriorly, posterior border rounded, embracing mesonotum; *mesonotum* transverse, narrow and rather flat above; *meso-epinotal* suture not very distinct on disc and only partly so at sides; *epinotum* long, narrow, sloping to base, angle between dorsal surface and declivity not very distinct. *Petiole* furnished with a bluntly pointed node-like scale, anterior surface convex, posterior surface flat, sculpture similar to that of thorax; *gaster* oval, shining, very finely transversely striate, the outstanding yellow setæ are longer and more abundant than elsewhere. *Femora* compressed; *tibiæ* cylindrical.

Long. 7.5 mm.

♀. Colour and sculpture similar to that of the soldier; *head* longer and narrower in proportion and more parallel-sided, about as broad anteriorly as posteriorly; *carina* on *clypeus* more distinct; *scape* longer in proportion, reaching pro-mesonotal suture.

Long. 4.5–5 mm.

Type and ♀ in B.M. (Nat. Hist.) Coll.

Described from one soldier and three workers (No. H.1384) taken by Mr. H. E. Box on young *Cacao* (shoots). British Togo, near Flabo Falls, 1200 ft. alt., Nov. 11, 1944; and one worker (No. H.1404) taken by Mr. J. Paine on seedling *Cacao* on edge of swollen-shoot outbreak. Gold Coast, Kwahu, Nov. 25, 1944.

Ants of the subgenus *Myrmopiromis* occur in South and West Africa, Madagascar, the Mascarene and the Seychelle Islands. They are divided into three groups—the *fulvopilosus* group consisting of a few rather large ants with a thick pile of hairs on the gaster, mostly found in South Africa; the *niveosetosus* group, small or medium ants, chiefly occurring in Madagascar. They are usually furnished with outstanding setæ, or hairs, yellow, red, or white. To this group our species belongs. It comes

nearest to *niveosetosus* Mayr, but is abundantly distinct. That species possesses a longer and narrower head, and the setæ are blunter and snow- or milk white, and are more abundant; and the *chrysurus* group, medium-sized ants, very few in number, with an impression in front of the epinotum. Widely distributed in Africa.

XXV.—*Descriptions and Records of Bees.*—CXCVI.

By T. D. A. COCKERELL, University of Colorado.

Halictus cerealis, sp. n.

♂.—Length about 8 mm., anterior wing nearly 7; black, slender, with narrowly fusiform abdomen; tergites 1 to 4 with narrow but conspicuous white tegumentary bands; pubescence scanty and white; head broad: clypeus entirely black; antennæ black, the flagellum long, very strongly moniliform; mesonotum and scutellum dull; area of metathorax large, dull with a rounded shining margin; tegulæ small, black, wings clear hyaline, stigma red, with a dark margin; nervures rather pale, but all distinct; second submarginal cell large and very broad, receiving first recurrent nervure not far from end; third submarginal cell little produced apically; legs black, with white spurs; abdomen shining, without hair-bands; apex of third sternite with a long outstanding white fringe.

Cape Province: Ceres, 1500 ft. Dec. 1920 (*R. E. Turner*).

Resembles *H. pensoni* Ckll., but distinguished by the slender abdomen, with outstanding fringe beneath, and the clear hyaline wings. *H. tenuimarginatus* Friese, which is also closely allied, has the clypeus with a light apical band.

Halictus andersoni, sp. n.

♀.—Length about 6 mm., anterior wing 5; black, the first four abdominal tergites with linear white tegumentary bands; flagellum obscurely brownish beneath; hind tarsi brown; pubescence scanty, dull white, floccus on hind femora very large; tegulæ very dark brown; wings hyaline, faintly dusky; stigma dark brown; head broad; clypeus shining, front dull; mesonotum shining; area

of metathorax large, dull, not plicate, with a narrow shining margin; nervures dark, second submarginal cell moderately contracted above, receiving first recurrent nervure well before end; third submarginal little produced apically; abdomen shining, the first tergite highly polished; no hair-bands.

Kenya: Solai District, Sonje Valley, Laikipia Escarpment, Sept. 15, 1919 (*T. J. Anderson*). It also bears a label by Uvarov, "*Halictus* sp., not in B.M."

Resembles *H. triflorus* Ckll., from Mt. Ruwenzori, but that has only three linear bands on abdomen, and the hair of the thorax is appreciably flavescent, while the abdominal bands are distinctly yellowish instead of clear white. There is also some resemblance to *H. perlucens* Ckll.

Halictus aberdaricus, sp. n.

♀.—Length about 9.5 mm., anterior wing 7.7 mm.; black, the first four abdominal tergites with linear, rather dull white, tegumentary bands; legs black, the hind tarsi obscurely reddish; antennæ black; wings strongly dusky; pubescence dull white, not at all reddish. Clypeus and supraclypeal area polished; mesonotum and scutellum dull, a little shining on disc; area of metathorax dull, not plicate, with a slightly shining margin; legs with pale hair, hind basitarsi broad; abdomen dullish, moderately shining, first tergite shining but not polished; tegulæ almost black; nervures all dark; stigma reddish, with a with a dark margin.

East side of edge of forest of the Aberdare Mts., 7300 ft. Feb. 24, 1911 (*T. J. Anderson*).

This belongs to the group without long spines or hind spur, and is related to *H. andersoni* Ckll., but much larger and less shining.

H. aberdaricus is represented in Uganda by a form with reddish hair (especially on scutellum) on thorax above. It may deserve to rank as a subspecies. The specimens (females) are from N. Bugisha, Jan. 12, 1930 (*H. Hargreaves*) and Mpanga Forest, Toro, 4800 ft., Nov. 13-23 1911 (*S. A. Neave*). The latter has red tegulæ.

Halictus lateronitens, sp. n.

♀.—Length about 7 mm., anterior wing 5.7; black, shining, the mesonotum highly polished, with scattered

small punctures, and strong notauli; pubescence white, conspicuous on postscutellum and pleura, but hardly evident on face; mandibles black; flagellum obscurely brownish beneath; head rather broad; clypeus and supraclypeal area dull, except that the lower marginal area of clypeus is shining and very coarsely punctured; front dull, but each side of face with a broad highly polished band; scutellum bigibbous, the elevations moderately shining; area of metathorax rather short, very densely covered with fine striæ or plicæ; tegulæ black, rather large; wings dusky, stigma large and dark brown, nervures dark, but the outer ones weakened; second submarginal cell broad; first recurrent nervure meeting inter-orbitus; third submarginal cell strongly bulging outward at end; legs black, with fine white hair; hind femora slender, but the tibiæ thick; hind spur with a series of short teeth; abdomen shining, with very inconspicuous pale tomentum at lateral bases of second and third tergites; fourth with a large conspicuous patch of white tomentum at lateral bases, and narrowly across in middle; fifth covered with short white hair.

Belgian Congo: Burunga (*J. Bequaert*). A peculiar species, perhaps to be compared with *H. atricrus* Vachel, which I have not seen, or with *H. schubotzi* Strand, which has considerably shorter wings. *H. perfumidus* Ckll. has several characters in common, but the mesonotum is dull.

H. pernitens Ckll. has the polished mesonotum, but the sculpture of area of metathorax is entirely different.

It is quite probable that in other specimens the pale hair on second and third tergites will appear more distinct.

Halictus masisiensis, sp. n.

♂. Length about 5 mm., anterior wing hardly 4; black, with the clypeus, mesonotum, scutellum and abdomen shining; mandibles and antennæ black, the flagellum long, faintly brownish beneath; head broad-oval; clypeus prominent, entirely black; area of metathorax rather large, dull, with a shining margin; tegulæ very dark brown; wings somewhat dusky, stigma and nervures dark brown, the outer nervures not weakened; second submarginal cell much narrower above, receiving recurrent nervure some distance before end; legs black; abdomen rather broad, without hair-bands or spots. Under the micro-

scope it is seen that the area of metathorax has strong, shining, minutely punctured plicæ on basal parts beyond which the surface is dull, without sculpture. The hind femora are sparsely clothed with long erect hairs.

Belgian Congo: Masisi, 1° S., 28° 30' E., Dec. 30, 1914 (*J. Bequaert*). This may be compared with *H. angustulus* Ckll., but that species has conspicuous white hair at apex of abdomen.

Halictus masaiensis, sp. n.

♀. Length about 8.5 mm., anterior wing 5.5; black, including mandibles, antennæ (flagellum obscurely brownish beneath) and legs (small joints of tarsi reddish, and a copper-red brush at end of hind basitarsi); pubescence dull whitish, not dense at sides of face; head rather broad; clypeus moderately shining, with a median pit; supra-clypeal area shining; a narrow shining band along orbits; mesonotum and scutellum polished, the latter not evidently linodose; no conspicuous patch of hair on post-scutellum; area of metathorax with close-set but distinct plicæ; tegulæ very dark brown, almost black; wings dusky; stigma rather narrow, dusky reddish; nervures brown, outer nervures weakened; second submarginal cell very broad, receiving recurrent nervure at apical corner; third submarginal hardly as broad as second on marginal; hind spur with a series of short broad lamellæ, the middle one largest; abdomen only moderately shining; second tergite with an entire but inconspicuous basal band of cinereous tomentum; third with such a band obscurely indicated, narrowed to a line in middle; fifth tergite shining.

British E. Africa: Masai Reserve, 7. 5. 1913 (*T. J. Anderson*).

A specimen from Kabete, Sept. 23, 1918 (*T. J. Anderson*) has a broader head, and the whiter and more distinct abdominal hair-bands differ, that on base of second tergite interrupted, on base of third almost concealed, but on fourth and fifth entire and very distinct. The hind spur seems to be of the same type. This may be a distinct species, but it is provisionally referred here as variety *a*.

H. stellatifrons Ckll., from the Aberdare Mts., has the head smaller, broad, mesonotum less shining, abdomen different. It is also a smaller species.

Halictus zanzibarius, sp. n.

♂. (Type). Length about 5 mm., anterior wing 3·7; black; the margin of clypeus broadly yellow, the labrum reddish yellow, the mandibles yellow except at base; tibiae and tarsi light yellow; femora black, with the apex and more or less of underside yellow; head rather broad; mouth-parts when extended very long, much longer than length of head; antennae moderately long, dark, the scape pale at base; face and front densely covered with white tomentum; mesonotum shining, finely and distinctly punctured, the median groove distinct; sides with a pale band of tomentum; scutellum shining, slightly bigibbous; postscutellum densely covered with yellowish-white tomentum, making a conspicuous spot; area of metathorax somewhat glistening, with a reticulate sculpture; tegulae small, pale testaceous; wings clear hyaline, stigma and nervures very pale; second submarginal cell rather narrow, receiving recurrent nervure not far from end; abdomen robust, shining; first tergite covered with white tomentum basally and at sides, the limit of the covered area sharply defined; second with a basal band of white tomentum, and a narrow apical one, interrupted in middle; third similarly ornamented, but the interrupted apical band stronger; fourth and fifth with pale hair, the fourth with a narrow base band; apical plate dark, broad and rounded.

♀. Similar in most respects, but the shining clypeus and the mouth-parts black, except that the mandibles are largely red; face and front with dense white hair; legs reddish yellow; hind spur with four spines, the first three long and slender; apical band on third tergite broad and entire.

Zanzibar: near Mazi Moja, Aug. 20 to Sept. 11, 1924 (*H. J. Snell*), 8 ♂, 4 ♀. It is not closely related to any species from the east coast of Africa, but in the table in *Ann. & Mag. Nat. Hist.*, June, 1939, it runs nearest to *H. jessicus* Ckll., which has a quite different abdomen, and comes from S. Rhodesia.

Halictus pembensis, sp. n.

♀. (Type). Length about 4·3 mm., anterior wing 3·3; black, the mesonotum, scutellum and abdomen polished; head rather broad, clypeus and supraclypeal area shining;

face and front not conspicuously hairy; flagellum dusky reddish beneath; thorax small; mesonotum without lateral hair-bands; postscutellum with a band of pale tomentum; area of metathorax dull, with excessively fine sculpture; tegulae very dark, slightly brownish; wings hyaline, the apical part slightly dusky; stigma and nervures very pale; second submarginal cell small, receiving recurrent nervure not far from end; abdomen robust, with little hair, but a distinct subapical band on third tergite; there are also rather indistinct bands at base of second and third tergites. The hind spur has three spines, the first two long.

♂. Similar; mouth-parts all dark; sides of face and front with pale tomentum; antennae longer; the flagellum red beneath; legs black.

Zanzibar: Pemba Island. Sept. 11–23, 1924 (*H. J. Snell*). Not allied to any species in adjacent territories. It may be compared with *H. hancocki* Ckll., and *H. picaninus* Ckll., from Uganda, *H. hancocki* is very much larger, and *H. picaninus* has a dull mesonotum.

Halictus walikalensis Cockerell.

The following are appreciably larger than the type, but evidently the same species.

Belgian Congo: Boma, Aug. 4, 1920 (*Dr. Rodhain*).

Sierra Leone: Njala, Aug. 25, on oil palm (*E. Hargreaves*).

S. Nigeria: Ibaden, Nov. 2, 1920.

Related to *H. magretti* Vachal, but not the same. *H. bellulus* Vachal differs by the black legs.

Halictus trianguliferus, sp. n.

♀. Length about 6 mm., anterior wing 4; black, robust, the tarsi reddened apically; hair of head and thorax scanty, but postscutellum densely covered with yellowish tomentum; head broad; clypeus and supraclypeal area, and a narrow line along orbits shining; antennae black; mesonotum and scutellum dull, the mesonotum marginal with pale hair, but this is not conspicuous; area of metathorax very large, shining, weakly sculptured, but without evident plicae; tegulae obscurely reddish; wings somewhat dusky, stigma and nervures very pale; second

submarginal cell receiving recurrent nervure at extreme apex; abdomen broad, shining, first tergite with a conspicuous elongated patch of hair on each side, second to fourth with basal greyish hair-bands, broadened at sides on second, on third very broad, and on fourth almost covering the entire tergite. Hind spur with two large blunt spines on the basal portion, the apical portion long and slender.

Zanzibar: near Mazi Moja, Aug. 20–Sept. 11, 1924 (*H. J. Snell*).

Related to *H. tanganus* Ckll., from Tanga, with the same triangular flattened area on clypeus, but that has the mandibles mainly red, the tegulae light reddish, and the supraclypeal area dull.

Halictus chrysurellus, sp. n.

♀. Superficially like *H. trianguliferus*, so that at first I took it for the same species, but it is certainly distinct by the following characters: front shining; the clypeus in *H. trianguliferus* seen from below, presents a shining triangular sculptured area, not seen in the present species; mesonotum shining, but not polished; hair of postscutellum white; stigma smaller and paler; basal white hair-bands on second and third tergites, but not on fourth; margin of fourth tergite pallid; apex of abdomen pale. Under the microscope, the hairs on the last two tergites are golden.

Zanzibar: near Mazi Moja, Aug. 20–Sept. 11, 1924 (*H. J. Snell*).

Halictus mazicus, sp. n.

♂. Length about 6.4 mm., anterior wing 5; black, rather slender, with a long parallel-sided abdomen; head broad, but orbits converging below; mouth-parts dark, but clypeus with a large triangular pale yellow apical mark; face and front hoary with pale pubescence; antennae very long, black; mesonotum dull, with some pale hair in middle anteriorly; scutellum bigibbous, the elevations shining; postscutellum with dense pale tomentum; area of metathorax large, pointed behind, shining with strong plicae which do not reach the apex; tegulae with a red spot; wings hyaline, faintly greyish apically; stigma dark brown; nervures brown, outer

nervures not weakened; second submarginal cell narrow, receiving recurrent nervure at apical corner; legs black; abdomen polished, with obscure triangular patches of greyish tomentum at lateral bases of second and third tergites.

Zanzibar: near Mazi Moja, Aug. 20-Sept. 11, 1924 (H. J. Snell).

I also refer here a male from Chiromo, Nyasaland (R. C. Wood, 2121). It has the plicæ on the polished area of metathorax shorter and less well developed, and the lateral patches on second and third tergites are connected by a slender basal band extending right across. A conspicuous feature is the white hair on underside of body, including the abdomen; it seems to be more developed than on the type. In spite of these small differences, the two specimens must be referred to the same species.

In the key in Ann. & Mag. Nat. Hist., June, 1939, this runs to *H. parvulinus* Ckll., from Cape Town, but that is much smaller, with the flagellum red beneath.

Halictus bianonis, sp. n.

♀. Length about 4 mm., anterior wing 3.5; head, thorax and abdomen bluish green, tergites pallid at apex, but no hair-bands or spots. Almost exactly like *H. zimbabericus* Ckll., but smaller, with the head more oblong and the face narrower; wings clear, with the stigma and nervures extremely pale. The area of metathorax appears dull and rugulose under a lens, with the apical margin shining. The microscope shows very delicate irregular plicæ and fine pitting.

Katanga: Bianco, Aug. 8-11, 1931 (Alice Mackie). This is so like *H. zimbabericus* that I hesitated to separate it, but the characters of the head and wings seem decisive. The shining bright green abdomen and other characters separate it from *H. angustulus* Ckll., also found at Bianco.

Halictus mosselinus, sp. n.

♀. Length about 8 mm., anterior wing 5.7; head, thorax and legs black, the small joints of tarsi reddish; abdomen red, with the first tergite black at base, second with a small elongate black mark at each side, third

largely black at sides, fourth black right across at base fifth black; pubescence pale-greyish, scanty, more abundant at sides of thorax, thick and slightly reddish at end of abdomen; mandibles black; flagellum red beneath; head not very broad; mesonotum and scutellum highly polished, the scutellum slightly bigibbous; area of metathorax shining, with delicate plicæ, easily visible under a lens; tegulæ rather large, black; wings reddish, the large stigma red, the nervures mostly pale, but the basal and marginal dark; second submarginal cell broad, moderately narrowed above, receiving recurrent nervure before end, abdomen shining, first tergite highly polished.

Cape Province: Mossel Bay, Sept. 1933 (*R. E. Turner*). Two specimens, one with the abdomen lost beyond the first tergite. Recognised among the species with red abdomen by the black tegulæ, and the sculpture of metathoracic area, which suggests that of the otherwise different *H. claricinctus* Ckll. It differs from *H. prolitus* Ckll. by the black tegulæ and shining, plicate, area of metathorax.

Turner took three small species of *Halictus* with red abdomen at Mossel Bay, the others being *H. volutatorius* Cam. (March 15–April 20) and *H. villosicardus* Ckll. (August).

Ten specimens from Swellendam, Nov. 1933, and ten from Katberg, 4000 ft., nine October 1932 and one Jan. 1933, are very variable, but are referred to *H. volutatorius*. The Katberg insect averages smaller, and generally has the apical part of the abdomen largely black. It may be that there are two species involved. Provisionally, the Katberg form may be called variety *a*. There is also a single *H. volutatorius* from Worcester, Sept.–Oct. 1931 (*Turner*).

Halictus ausicus, sp. n.

♀. (Type). Length slightly over 6 mm., anterior wing 4; head and thorax black, abdomen red; mandibles red, black at base, inner tooth well developed; antennæ black; legs black, the tarsi reddish at end; pubescence scanty, very thin on face and front; head rather broad; clypeus and supraclypeal area shining; mesonotum and scutellum polished, the scutellum not depressed in middle;

area of metathorax dull, its margin not interrupted in middle; tegulae dark reddish; wings clear hyaline, stigma pale yellowish; nervures pale; second submarginal cell rather small, contracted above, receiving recurrent nervure just before end; abdomen broad, shining, rather dark red, except that the first tergite is black at base; no black spots at sides of tergites.

♂. Length hardly 6 mm.; more slender; clypeus with no light band; antennae black, rather short for a male; abdomen more broadly black at base, and infuscated apically; apex with a rounded reddish plate; tarsi red.

S.W. Africa: Aus, 1 ♀, 7 ♂, Nov. and Dec. 1929 (*R. E. Turner*, 20).

Closely allied to *H. volutatorius* Cam., but differs by the very clear wings, with paler stigma and nervures, and the red mandibles. The male is easily known from *H. pearstonensis* Cam. by the pale stigma.

All the above bees belong to the British Museum, and will be returned there before long.

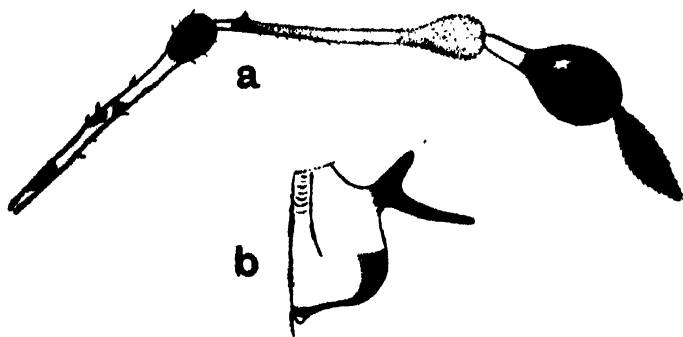
XXVI. *A New African Species of Miridæ (Opsidæ), Hemiptera, Heteroptera.* By W. E. CHINA, M.A., F.R.E.S.

THE following description is based on material collected by Mr. H. E. Box, and submitted to me for determination, during his work on the West African Cocoa Pests:—

Physophoropterella pachylobi, sp. n.

♂ and ♀.—Shining yellow with the following shining black markings:—Lateral and posterior margins of head behind eyes with a median narrow interruption, clypeus, apex of rostrum, a wide sub-basal ring on first antennal segment, apical swelling of same, two narrow half rings close together in middle of this segment and a few small black spots, a sub-basal ring at the sub-basal tooth of second antennal segment which is also black, swollen apical two-thirds of third antennal segment, the bifid spine of the scutellum and penultimate apex of same, a

spot close to base hemielytron extending from corium on to clavus, a broad spot towards apex of corium extending from costal margin nearly to inner apical margin of corium and covering the conical shield-shaped elevation at this point, the apical swollen third of cuneus, the inner apical margin of corium very narrowly, apices of all femora broadly, bases of all tibiæ more narrowly, an irregular sub-apical ring and some small spots on all femora, an irregular sub-apical ring on middle and hind tibiæ, a supra-median irregular ring and some small spots



Physophoropterella pachylobi, sp. n.

a. Antenna. b. Lateral view of scutellum.

on all tibiæ, apices of all tibiæ and the apical segments of abdomen. The latter with some sanguineous colouring adjoining the black in the male. Scutellum with the posterior lobe largely brown, the brown area connected with base of bifid spine by a brown line. Extreme apex of scutellum sordid yellow. Apex of humeral angles of pronotum lightly infusate. Membrane of hemielytron infusate with a pallid spot at base adjoining apex of cuneus. Apical swelling of second antennal segment fulvous, that part of the segment between the black tooth and the apical swelling, pale sordid fulvous with an obscure pallid ring just below the base of the apical swelling. Fourth antennal segment dull brown. Tooth of second antennal segment placed very close to base of segment,

Relative lengths of male antennal segments 74 : 75 : 55 : 28 and of female segments 65 : 68 : 50 : and 25.

Hind wings hyaline with apical third infusate. Largely glabrous, except for scattered short pale bristles on antennæ and legs, those on black nodular apical and annular swellings of femora darker and slightly thicker, but the swollen apex of the second antennal segment and the whole of the third and fourth segments with a dense short soft pubescence, and the apical half of the tibiæ and the tarsi also with a dense pale pubescence.

Length.—♂ 9 mm., ♀ 10.5 mm. : width across humeral angles : ♂ 3 mm., ♀ 3.5 mm.

Habitat.—FRENCH CAMEROONS : near Loum, 2 ♂♂ (including type) and 3 ♀♀, feeding in all stages on the foliage of *Pachylobus edulis* (H. E. Box, Coll. No. H. 1828).

Closely allied to *Physophoropterella denticollis* Reut. and Popp., which, however, was described from a single badly-preserved specimen without legs or antennæ. Differs from Reuter and Poppius' coloured figure (Trans. Ent. Soc. London, 1911, pl. 32, fig. 2a) in the absence of the reddish colouring on the posterior lobe of the pronotum and scutellum and in the much larger size, 9–10 mm. long instead of the 7 mm., given for *P. denticollis*. The anterior dorsal spine of the scutellum is thinner than that shown for *P. denticollis* (fig. 2b). The black colour on the head is also much reduced and confined to a narrow posterior arc extending from behind the eye to middle line on each side of head. Differs from *P. bondroiti* Popp. in the larger size, 9–10 mm. long instead of 7.4 mm., in the not all black head and differently arranged black rings or spots on femora and tibiæ. Differs from *P. venefica* Schum. in having the swollen apex of the second antennal segment fulvous instead of black. Reuter's, Poppius' and Schumacher's species are known to me only from the descriptions and figures.

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[ELEVENTH SERIES.]

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XXVII.—*On the East African Species of Polyclæsis (Col., Curcul.)*. By Sir GUY A. K. MARSHALL, K.C.M.G., F.R.S.

THE strikingly coloured weevils of this genus present many taxonomic difficulties, but as there are in East Africa a number of obviously undescribed species, a preliminary attempt has been made to unravel their relationships. Only those species occurring in Kenya, Tanganyika, Nyasaland and Northern Rhodesia are here dealt with, and it is in the first two countries that the genus attains its greatest development and seems to be undergoing speciation in relatively restricted areas.

In a few species, such as the South African *equestris* Boh., the sexes are exactly alike and can be distinguished externally only by the form of the fifth visible ventrite, the apical margin of which is shallowly sinuate in the middle in the male and arcuate in the female—a sexual distinction observed in all the species examined.

In most other species, and especially in those allied to *longicornis* Fhs., the females differ greatly from the males in colour, scaling and structure, so that it is sometimes difficult to associate the sexes with certainty, and in several cases they have been described as distinct species. On the other hand, the inter-specific differences in the females are often slight or elusive and difficult to describe, so that the key given below must be regarded as merely tentative, pending the receipt of more adequate material. Several apparently distinct species known from females only have therefore not been dealt with.

P. curvispinis Chev. was described from a female from Lake Ngami, but Kraatz (Dout. ent. Zeits. 1896, p. 184) has also recorded the species from Tanganyika. From our present knowledge of the range of the species in this genus such a distribution seems highly improbable. I have seen two females from Ngami which agree well with Chevrolat's description, and they are certainly referable to *longicornis* Fhs., which is in accordance with what one would expect. I therefore regard *curvispinis* as a synonym of *longicornis*. Further, there can be no doubt from the description that *squamuliventris* Qued. is synonymous with *auriventris* Chev.

P. mellyi Chev. is another species originally described from South Africa and later recorded from Tanganyika, and for the same reason the latter locality must be regarded as dubious. The species was based on a female, and the description affords no character to distinguish it from the variable female of *longicornis* Fhs., but it cannot be treated as a synonym until the type has been examined, because the precise place of origin is unknown.

P. angusticollis Ancey is undoubtedly a synonym of the South African *plumbeus* Guér.

The type of *P. scotti* Hust., which was described as a female but is really a male, is a synonym of *nobilitatus* Ancey, of which I have seen four specimens from Somaliland and a series of 70 from Abyssinia (in the Glasgow University Museum). It is very variable in size, and the elytra vary from black to chestnut, the yellow markings also being often much reduced. A male of *castaneipennis* Hust., from Harrar, Abyssinia, received from the Congo Museum, must also be referred to *nobilitatus*.

In many males of this genus the pale markings on the elytra assume a very characteristic pattern, and to avoid undue repetition this will hereafter be referred to as the *longicornis* pattern. These markings are formed of setæ or scales tapering to a seta, and in perfect specimens they are covered with a pale yellow powder; they are arranged as follows:—(1) a marginal stripe starting close to the base below the shoulder, continuing backwards to about one-fourth and then bent sharply inwards, extending at most to stria 4, but often shorter; (2) a discal spot just behind the middle on intervals 2-4, varying a good deal in size

and shape in the same species; and (3) a postmedian elongate lateral spot on intervals 8 and 9.

The South African species, with one exception, feed on *Acacia*, being often very plentiful when the trees are in flower; and Mr. A. J. F. Gedye informs me that such species as he has seen in Kenya also occur on *Acacia*. The exception referred to above is *P. decorus* Pér., which I found on *Brachystegia* sp.; this species belongs to a small group that comprises also *wittei* Hust. (Katanga dist., Belgian Congo) and *crokisi* Dohrn (Gold Coast).

Key to Males of East African Polyclæsis.

- 1 (8). Funicle with joint 2 distinctly longer than 1; upper surface with sparse long erect hairs; inner face of hind tibiae broadly flattened and bearing a dense mass of long soft curled erect hairs.
- 2 (3). Ventrite 5 with a large median tuft of dense erect hairs (N.W. Rhodesia) *1. criniventris*, sp. n.
- 3 (2). Ventrite 5 with only sparse erect setæ and no median tuft.
- 4 (5). Elytra narrow, the metallic scales on their basal half very small, round or nearly round; male aedeagus only slightly widened distally, the fold on the apical margin three-fifths the width of the spatula (Tanganyika)..... *2. angustius*, sp. n.
- 5 (4). Elytra broader, the metallic scales narrow, acuminate or even setiform; male aedeagus broadly dilated distally, the fold on the apical margin not more than half the width of the spatula.
- 6 (7). Mucro of front tibiae very large, triangular and forming a wide angle with the strongly arcuate apical margin of the tibia (Tanganyika)..... *3. ukamiensis*, sp. n.
- 7 (6). Mucro of front tibiae small; almost in a line with the subtruncate apex of the tibia (Nyassaland to Natal) *longicornis* Fhs.
- 8 (1). Funicle with joint 2 not, or very slightly, longer than 1; upper surface without long erect hairs (except in *angulifer* and *pubicollis*).
- 9 (12). Upper surface with soft erect hairs; disk of pronotum transversely carinate.

- 10 (11). Head smooth, with sparse shallow punctures, width of frons not greater than the length of an eye; general clothing above and below formed of blue recumbent setae; post-humeral yellow band on elytra connected with the postmedian discal spot by a yellow stripe along interval 4 (Kenya) 8. *angulifer*, sp. n.
- 11 (10). Head with rugose, longitudinally confluent punctures, width of frons greater than the length of an eye; general clothing of grey setae; post-humeral yellow band not connected with the postmedian spot (Tanganyika) ... 9. *pubicollis*, sp. n.
- 12 (9). Upper surface without erect hairs.
- 13 (40). Rostrum much longer than an eye; width of frons not less than the length of an eye; elytra without a long yellow stripe on interval 4.
- 14 (19). Pronotum opaque, with dense rugulose punctures, the basal angles right angles; body without any blue or green scales or setae.
- 15 (18). Legs mostly red, front tibiae not denticulate, hind tibiae straight on inner face, joints 5-7 of funicle transverse; elytra rugosely punctate, the yellow pattern fully developed.
- 16 (17). Prothorax rather strongly rounded laterally, widest at middle; general clothing of elytra formed of rather dense small narrow brownish scales, the pale discal spots formed of oval non-acuminate scales (Uganda) 11. *carpentieri*, sp. n.
- 17 (16). Prothorax parallel-sided in basal two-thirds; general clothing of elytra formed of sparser yellowish setae, the pale discal spots formed of narrow, sharply acuminate scales (Kenya) 10. *opiko*, sp. n.
- 18 (15). Legs black, front tibiae finely denticulate on lower edge, hind tibiae distinctly sinuate on inner face; joints 5-7 of funicle at least as long as broad; elytra finely and densely granulate, the yellow pattern much reduced (Tanganyika) *stuhlmanni*, Klb.
- 19 (14). Pronotum shiny, with fine shallow punctures, the basal angles acute; body with blue or green scales or setae (but mainly grey in *m. maculatus*).

- 20 (37). Elytra with well-defined yellowish markings (*longicornis* pattern); aedeagus with the sulcus before the spatula not or but little longer than the spatula, which is wider than the tube.
- 21 (30). Basal half of the elytra with nearly round or narrow scales, and sparse scales on the disk of the pronotum; inner face of hind tibia distinctly sinuate and with numerous erect setae.
- 22 (23). Eyes not projecting laterally beyond the line of the temples (Tanganyika) 4. *albicans* Chev
- 23 (22). Eyes projecting beyond the line of the temples.
- 24 (25). Anterior pairs of tibiae with sparse long erect setae on all sides, femora with a dense fringe of erect setae beneath; scales on basal half of disk of elytra almost round or broadly ovate (Tanganyika) 5. *crispipes*, sp. n.
- 25 (24). Anterior pairs of tibiae without erect setae dorsally or externally, femora without an erect fringe beneath; scales on basal half of elytra narrow.
- 26 (27). Prothorax with a sharp lateral process in the basal angles (Kenya) *ocellatus* Gerst.
- 27 (26). Basal angles of prothorax without a lateral process.
- 28 (29). Frons deeply depressed, head and rostrum with sparse scales and setae; prothorax slightly transverse, widest at base and gradually narrowing anteriorly (Kenya) 6. *nevus*, sp. n.
- 29 (28). Frons almost flat, head and rostrum with rather dense scales and setae; prothorax markedly transverse, parallel-sided in the basal third (Tanganyika) 7. *patulus*, sp. n.
- 30 (21). Elytra and pronotum clothed only with short setae, without any trace of scales; inner face of hind tibiae almost straight, with only sparse setae 13. *maculatus*, Boh
- 31 (36). Pronotum with fine separated punctures and no transverse basal impression; subapical lateral spot on elytra well developed; aedeagus with the dorsal outline markedly sinuate in lateral view, the spatula only slightly wider than the tube.

- 32 (35). Elytra with the post-humeral yellow band extending broadly from the lateral margin to stria 4.
- 33 (34). Elytra less acuminate apically, beginning to narrow well behind the middle; apical thickening of the sodeagus small (Sudan) . . . *m. maculatus* Boh.
- 34 (33). Elytra more acuminate apically, beginning to narrow at or before the middle; apical thickening of the sodeagus of nearly twice the size (Kenya) *m. acuminatus*, nsp. n.
- 35 (32). Elytra with the post-humeral yellow band greatly reduced, not extending inwards beyond stria 8 (Uganda) *m. ugandanus*, nsp. n.
- 36 (31). Pronotum with coarser, transversely confluent punctures and a deep transverse basal impression; subapical lateral spot on elytra absent; sodeagus with the dorsal outline almost flat, the spatula markedly wider than the tube (Tanganyika) 14. *reductus*, sp. n.
- 37 (20). Elytra without sharply defined yellowish markings; sodeagus with the sulcus before the spatula more than twice as long as the spatula, which is not wider than the tube 15. *auriventris* Chev.
- 38 (39). Elytra with uniform greyish-green or greyish-coppery setiform scales (Tanganyika) *a. auriventris* Chev.
- 39 (38). Elytra with faint ill-defined greenish or yellowish-green markings (Kenya) *a. oblitus*, nsp. n.
- 40 (13). Rostrum not or but slightly longer than an eye; width of frons less than the length of an eye, eyes very large and flat; elytra with a long yellow stripe on interval 4 from near base to far behind middle (Kenya) . . . 16. *macrops*, sp. n.

Key to Females of East African Polyclæsis.

- 1 (10). Prothorax with the basal angles strongly produced outwards laterally.
- 2 (9). Elytra with only recumbent setae.
- 3 (6). Pale markings on elytra formed entirely of normal scales, general scaling brownish; prothorax with broad scales scattered over the disk.
- 4 (5). Form proportionately shorter and broader; eyes more convex,

exceeding the line of the temples; ventrite 5 without lateral impressions.

longicornis, Fhs.

1. *criniventris*, sp. n.

- 3 (4). Form longer and narrower; eyes flatter, not or very slightly exceeding the line of the temples; ventrite 5 with a short longitudinal impression on each side near the base (Tanganyika). . .
- 6 (3). Pale markings on the elytra formed principally of pointed scales ending in a seta, general scaling blue, green or coppery; disk of prothorax setose, with scales along the middle line only.
- 7 (8). Prothorax widening rapidly towards the base, the basal angles more produced; eyes not or but slightly exceeding the line of the temples (Tanganyika).
- 8 (7). Prothorax less widened basally and appearing less transverse, the basal angles somewhat shorter and sharper; eyes more convex, distinctly exceeding the line of the temples (Kenya). . . .
- 9 (2). Elytra with sparse fine erect setae and brown scales (Tanganyika).
- 10 (1). Prothorax with the basal angles rectangular or acute, not or but slightly produced laterally.
- 11 (24). Sides of metasternum densely squamose.
- 21 (23). Eyes convex, much shorter than the rostrum; the width of the frons equal to or greater than the length of an eye; elytra not striped.
- 13 (18). Prothorax much narrower at apex than at base, the disk finely punctate; eyes moderately convex.
- 14 (17). Frons not or but shallowly impressed; the median sulcus on rostrum normal, about one-fourth the width of the adjoining areas; elytra with striae more deeply impressed near base, so that the suture is there raised.
- 15 (16). Sides of rostrum clothed with scales and setae; eyes more convex; scales on elytra broader (Tanganyika).
- 16 (15). Sides of rostrum clothed with setae only; eyes less convex; scales on elytra narrower, especially near the base (Kenya). . . .

4. *albicans* Chev.

3. *ukamensis*, sp. n.
5. *crimpes*, sp. n. ?

ocellatus Gerst.

2. *angustus*, sp. n.

15. *auriventris* Chev.

a. auriventris Chev.

a. oblitus, sp. n.

- 17 (14). Frons deeply impressed; the median sulcus on the rostrum unusually broad, two-thirds the width of the adjoining areas; elytra with the suture not raised near the base (Kenya) 6. *newius*, sp. n.
- 18 (13). Prothorax only slightly narrower at apex than at base, coarsely and closely punctate; eyes strongly convex.
- 19 (20). Pronotum with the basal transverse impression deep; legs with numerous broad scales as well as setae; elytra with the post-humeral pale band very broad and extending forwards below the shoulder (N.W. Rhodesia) . 12. *dollmani*, sp. n.
- 20 (19). Pronotum with the basal transverse impression very shallow or obsolescent; legs entirely setose or with some setiform scaling; elytra with the post-humeral band narrow, macular and remote from the shoulder.
- 21 (22). Posterior pairs of tibiae with long erect setae on the inner face only; venter without soft erect hairs except near the apex; mesepisterna much more densely squamose than the mesepimera (Uganda) 11. *carpentari*, sp. n.
- 22 (21). Posterior pairs of tibiae with long erect setae on the outer face also; venter with sparse erect hairs throughout; mesepisterna not more densely squamose than the mesepimera (Tanganyika) .
- 23 (12). Eyes unusually large, almost flat, nearly as long as the rostrum; frons narrow, its width only two-thirds the length of an eye; elytra with the scales dense in the striae and sparse on the intervals, causing a striped appearance (Kenya) 9. *pubicollis*, sp. n.
- 24 (11). Sides of metasternum setose only.
- 25 (30). Eyes not or but slightly exceeding the line of the temples; elytra of normal width; prothorax and elytra black, the latter with a postmedian discal spot.
- 26 (29). Elytra with pale blue scaling; sexes somewhat similar.
- 27 (28). Elytra with fine separated punctures on the disk, lateral yellow markings fully developed; femora red with the knees black; metasternum squamose in middle (Kenya) 16. *macrops*, sp. n.
13. *n. acuminatus*, sp. n.

- 28 (27). Elytra rugulose, lateral yellow markings much reduced; legs entirely black; metasternum setose throughout (Tanganyika) 14. *reductus*, sp. n.
- 29 (26). Elytra with yellowish or brownish scaling; sexes dissimilar (Tanganyika) *stuhlmanni*, Klb.
- 30 (25). Eyes strongly convex, elytra unusually long and narrow; head and rostrum black, prothorax and elytra red-brown, the latter without a postmedian discal yellow spot (Kenya) 8. *angulifer*, sp. n.

1. *Polyclæis criniventris*, sp. n.

♂. This species closely resembles *P. longicornis* Fhs. in colour and structure, but in this sex differs from it in having a large tuft of dense soft erect hairs occupying the whole median area of the 5th visible ventrite a character that has not been observed in any other species in the genus. There is also a marked difference in the male ædeagus: in *longicornis* the spatula is much wider and its apical margin is broadly subtruncate, the abruptly upturned margin forming a sharp transverse ridge; in *criniventris* the spatula is much narrower, its apical margin being rounded and obtusely thickened.

♀. No character has been found by which to distinguish this sex from that of *longicornis*. The projecting basal angles of the prothorax are normally broadly truncate, but occasionally they are almost pointed.

Length 14–16 mm., breadth 5–6 mm.

N. W. RHODESIA: Broken Hill, 26 ♂, 14 ♀, xi. 1914 (type); Mwengwa, 1 ♂, xi. 1913; Kashitu, 1 ♀, xii. 1914 (all *H. C. Dollman*).

2. *Polyclæis angustus*, sp. n.

♂. Derm black, with soft erect hairs above and below; prothorax with a yellowish lateral stripe, the disk with sparse setæ and a few blue scales, chiefly along the middle line and in the basal angles; elytra with a general clothing of very small separated round blue scales and yellowish or greenish markings of the *longicornis* pattern but somewhat reduced, the subhumeral mark being rarely entirely absent and the postmedian lateral spot usually very small; underside with bluish setæ except for some blue

scales on the mesepisterna and on the sides of the metasternum and 1st ventrite.

General facies like that of *longicornis* Fhs. but much narrower. *Head* with the frons about as wide as the length of an eye, finely and sparsely punctate, varying from almost flat to deeply depressed, the median sulcus equally variable; eyes moderately convex. *Antennæ* elongate, joint 2 of the funicle much longer than 1. *Prothorax* moderately transverse (9 : 11), excluding the processes in the basal angles, which are short and acute, the sides gently rounded, almost parallel in the basal third; dorsum sparsely and shallowly punctate, the basal transverse depression broad and deep, the anterior half with a broader shallower impression, thus producing a low obtuse transverse ridge behind the middle. *Elytra* narrowly elongate, with a very small apical mucro; the striæ impressed, with close deep punctures that diminish behind, the intervals slightly convex, mostly broader than the striæ, with fine confluent punctures and more or less transversely wrinkled; the dorsal markings formed of dense pale green metallic scales and some yellowish setæ (in *longicornis* and *criniventris* they are formed of setæ only with yellow powder). *Legs* black, clothed with setæ and scattered blue scales; femora with a dense fringe of erect setæ on the lower face; tibiæ with long erect setæ on all sides, the hind pair broadly flattened on the inner face and with a fairly dense fringe of long hairs, but not nearly so dense as in *longicornis*, front pair with a strong sharp mucro.

Length 12.5–15.0 mm., breadth 4.5–5.0 mm.

♀. Differs from ♂ much as in the case of *longicornis*. Clothing consisting of rather larger, light brown scales, the pale markings on the elytra very variable and, when present, formed merely of similar denser brown scales; underside with dense paler scales throughout, except for a broad subdenuded median stripe on the metasternum and two basal ventrites.

Head with the eyes slightly less convex. *Antennæ* short, with the two basal joints of the funicle equal. *Prothorax* with the sides straight, more widened towards the base, and the basal angles slightly more produced.

Length 13.5–15.5 mm., breadth 4.5–5.5 mm.

TANGANYIKA: Lulanguru, 17 m. W. of Tabora, 3 ♂, 2 ♀, xi. 1917 (Dr. G. D. H. Carpenter—type); Msagaa, 9 ♂, 2 ♀, x.-xi. 1935 (E. Burtt); Ukerewe I., S.E. Lake Victoria, 4 ♂, 2 ♀ (Father P. A. Conrads).

The Ukerewe males look rather different because they are clothed with slightly larger and much denser scales of bright metallic green.

In addition to the characters given in the key, the males of *longicornis* Fhs. differ in having the prothorax more transverse and widening more towards the base, the fringe on the hind tibiae is much denser, the dorsal spots on the elytra are composed of setae only without any metallic scales, and the mucro on the front tibiae is much smaller.

The short erect setae on the elytra distinguish the females of *angustus* from all their allies.

3. *Polyclæsis ukamiensis*, sp. n.

♂. Derm black, the whole upper surface with rather sparse soft erect hairs; head and rostrum with very sparse bluish-green scales; prothorax with very short sparse greenish transverse setae, a few pale greenish scales along the middle line and the basal margin, and a broad lateral yellow stripe; elytra with the general clothing of narrow bluish-green scales, becoming setiform on the apical half, and with the typical yellow *longicornis* pattern, the markings being rather broader than usual, the post-humeral band nearly reaching stria 4; underside setose, except for a sublateral area of green scales on the metasternum and ventrite 1.

Head closely punctate on the vertex; frons shiny, impunctate, shallowly depressed, its width equal to the length of an eye; eyes only slightly exceeding the line of the temples. *Antennae* elongate, joint 2 of the funicle much longer than 1. *Prothorax* somewhat transverse, with the sides almost straight and widening much less towards the base than in *longicornis*, the projection of the basal angles rather short and very sharp; dorsum with sparse shallow punctures and transverse striolation, the transverse basal depression broad and deep. *Elytra* narrowly ovate, with the apical mucros obsolescent; the striae with rather large deep punctures, the intervals transversely rugulose; the yellow markings formed by

scales that taper into a seta at the apex. *Legs* black, with sparse blue scales and grey setæ; femora with a dense fringe of short erect setæ on the lower face; tibiæ with long erect setæ on all sides, the hind pair broadly flattened on the inner face and with a fairly dense fringe of long hairs, front pair with an exceptionally large triangular mucro.

♀. Black, with bronze or green scaling and no erect setæ; elytra bearing the *longicornis* pattern as in ♂ but somewhat reduced, the post-humeral band not exceeding stria 6; the metasternum with brownish scales.

Head with the frons more deeply impressed; eyes not exceeding the line of the temples. *Prothorax* more widened basally, with the angles more produced. *Elytra* much broader, less acuminate behind. *Legs* as in *longicornis* ♀.

Length 16-18 mm., breadth 5.5-7.0 mm.

TANGANYIKA: 2 ♀; Ukami Mts., 1 ♂, 2 ♀ (type).

The male of this species is superficially very similar to that of *albicans* Chev., but in addition to the characters given in the key the latter differs in its broader prothorax and the much smaller mucro on the front tibiæ, and the yellow discal spots are formed of setæ with a small bulb at the base. The female, however, is not like that of *albicans* but closely resembles that of *ocellatus* Gerst., which is a good deal smaller and differs as indicated in the key.

4. *Polyclæis albicans* Chev.

Previously (Ann. & Mag. N. H. (10) xv. 1935, p. 518) I regarded *albicans* as being the female of *auriventris* Chev., but having since seen a series of both sexes of the latter, it is clear that that was an error. I now provisionally associate with *albicans* some males taken with it at Dar-es-Salaam; these have bluish-green scales with the yellow *longicornis* pattern and superficially resemble *ukamiensis*, sp. n., but differ from it as indicated under that species. These males have been distributed by German dealers under the name of *curvispinis* Chev.

5. *Polyclæis crinipes*, sp. n.

♂. Derm black, without erect hairs above; head and rostrum with sparse bluish-green scales; prothorax with

the usual broad lateral yellow stripe, the disk with recumbent green setæ and some green scales along the middle line and in the basal impression; elytra with the yellow *longicornis* pattern, the post-humeral band reaching only stria 6, the basal half of the disk with close but separated, shortly ovate or almost round green scales, those on the apical half narrow; the sides of the metasternum with unusually large green scales among the setæ, the venter entirely setose.

Head very sparsely punctate; frons shiny, deeply impressed, its width equal to the length of an eye; eyes distinctly exceeding the line of the temples. *Antennæ* rather long, joint 2 of the funicle slightly longer than 1. *Prothorax* somewhat transverse, slightly rounded laterally, widening but little towards base, the basal angles very shortly and bluntly produced; dorsum shiny, with small sparse shallow punctures, the basal depression broad and deep, and a broad shallow one on the apical half. *Elytra* almost parallel from the shoulders to beyond middle, the apical mucros small; the striae shallow, with strong punctures basally which become much smaller behind, the intervals with small shallow punctures on the basal half, becoming finely rugulose behind; the discal yellow spots formed of pale metallic scales tapering to a seta at the apex. *Legs* black, with grey and greenish setæ and very sparse green scales; femora with a fringe of long soft hairs on the lower face; tibiae with sparse long erect setæ on all sides, the hind tibiae broadly flattened on the inner face and with a comparatively thin fringe of long hairs, front pair with only a small mucro.

Length 15 mm., breadth 5 mm.

TANGANYIKA: Mpwapwa, 1 ♂.

Most nearly allied to *albicans* Chev., which, apart from the less convex eyes, differs in having somewhat shorter thicker antennæ, the basal angles of the prothorax are sharp, the elytra are slightly more rounded laterally and the scales on the basal half much narrower, the yellow discal spots are formed of setæ with a small bulb at the base, and the legs are much less hairy.

A damaged female taken at the same place probably belongs to this species, but it is so close to the female of *ukamiensis*, sp. n., that it must remain dubious.

6. *Polyclæis nexus*, sp. n.

♂. Derm black, without any erect hairs; head and rostrum with rather sparse grey setæ and metallic scales; prothorax with a broad lateral stripe of pale setæ, the disk with grey setæ and some metallic scales along the middle line and base; elytra with the pale yellow *longicornis* pattern, the sides and apical half with grey and metallic setæ, the basal half of the disk with fairly dense narrow coppery scales; underside with blue setæ, the sides of the metasternum also with some large oval coppery scales and some much narrower ones at the sides of the two basal ventrites.

Head with a narrow band of coarse punctures across the vertex; frons impunctate, deeply impressed, its width equal to the length of an eye; eyes exceeding the line of the temples. *Antennæ* with two basal joints of the funicle subequal. *Prothorax* only a little broader than long, the sides very slightly converging from the base to beyond the middle, then curving inwards to the apex, the basal angles with a very small sharp projection; dorsum with very shallow punctures which are transversely confluent in the middle, the basal transverse depression shallow, the anterior part not depressed. *Elytra* narrowly ovate, gently rounded laterally, the apical mucros very short and not turned up; the shallow striae with strong close punctures that diminish somewhat behind, the intervals finely rugulose throughout; the discal yellow spots formed of narrow pale metallic scales that become setiform at the apex. *Legs* black, with grey setæ and very sparse metallic scales; femora without any erect fringe beneath; tibiae without erect setæ, except for a sparse fringe on the inner face of the hind pair, front pair with a normal mucro.

Length 14.5 mm., breadth 5.3 mm.

♀. Derm black, elytra dark red-brown, with small oval yellowish-grey scales and an ill-defined *longicornis* pattern formed of similar dense scales.

Rostrum with an unusually broad median sulcus. *Prothorax* more transverse, more widened basally, with the hind angles very acute and slightly projecting.

Length 15 mm., breadth 6 mm.

KENYA: Kinangop, 1 ♂, 1 ♀, xii. 1935 (A. F. J. Gedye).

7. *Polyclæis patulus*, sp. n.

♂. Derm piceous, without erect hairs; head and rostrum with rather dense coppery scales and grey setæ; prothorax with a broad lateral yellow stripe, the disk with grey setæ and scattered oval coppery scales in the middle; elytra with the yellow *longicornis* pattern, the sides and apical half with short grey setæ, the basal half of the disk with dense small narrow coppery scales; underside with rather dense grey setæ throughout, the sides of the metasternum with a wide stripe of broad coppery scales.

Head without conspicuous punctures; frons almost flat, its width equal to the length of an eye; eyes convex. *Antennæ* short, the two basal joints of the funicle equal. *Prothorax* distinctly transverse, parallel-sided in the basal third, then narrowing in a curve to the apex, the basal angles acute; dorsum with small distant punctures, but becoming transversely confluent in the middle, the transverse basal depression broad and deep, the anterior part not impressed. *Elytra* almost parallel in the basal half, the apical mucros short and not turned up, the striæ with strong close punctures that diminish behind, the intervals slightly convex, finely rugulose throughout; the discal yellow spots with narrow acuminate pale metallic scales. *Legs* red-brown, with grey setæ and scattered broad coppery scales, femora with rather dense suberect setæ on the lower face, hind tibiæ with a sparse fringe of erect setæ on the inner face only, front pair with a small mucro.

Length 13.5 mm., breadth 5.1 mm.

TANGANYIKA: (probably Tanga district), 1 ♂ (*J. A. J. Thompson*).

Allied to *nexus*, sp. n., but proportionately shorter and broader, with thicker legs and more convex eyes.

8. *Polyclæis angulifer*, sp. n.

♂. Derm black, with a general sparse clothing of pale blue setæ; the yellow markings of the usual *longicornis* pattern, except that the anterior transverse band unites broadly with a yellow stripe on interval 4 (often partly covering 3 and 5), which extends backwards and merges into the postmedian discal spot, and that the posterior lateral spot is much more elongate and reaches the apex

of stria 3; underside with blue setæ; upper surface with short fine erect setæ.

Head smooth, with sparse shallow punctures; frons not depressed, its width not greater than the length of an eye, the median sulcus varying in length and depth; eyes strongly convex. *Antennæ* short, with the two basal joints of the funicle equal. *Prothorax* gently rounded laterally, widest behind the middle, a little narrower at apex than at base, the basal angles rectangular, not produced laterally; the thinly setose dorsum transversely carinate, the transverse basal depression shallow. *Elytra* comparatively narrow and elongate but much wider at the roundly rectangular shoulders than the base of the prothorax, with a short sharp apical process; the striae impressed, closely and strongly punctate almost to the apex, the intervals on the basal half narrower than the striae and finely rugulose. *Legs* red-brown, with the knees and front tibiae and tarsi blackish; all the legs with rather sparse erect setæ on every side, the hind tibiae straight and without any dense fringe on the inner face.

Length 8.5-11.0 mm., *breadth* 3.0-3.8 mm.

♀. *Derm* red-brown, the head, rostrum and underside blackish; the dorsal clothing thin, formed of small yellowish setiform scales, the yellowish lateral stripes on the elytra similar to those of ♂, but the basal one not extending inwards behind the shoulder beyond interval 8 (except occasionally for a small isolated spot in stria 6), the stripe on interval 4 entirely absent, and the postmedian discal spot absent or reduced to two indistinct small spots in striae 3 and 4 respectively, underside with yellowish setæ; body without any erect setæ.

Structure as in ♂, except: *Prothorax* with the sides almost straight; dorsum with fine sparse punctures or finely striolate transversely on the disk. *Elytra* even longer and narrower. *Legs* paler and more slender, without erect setæ except on the inner face of the tibiae.

Length 11-12 mm., *breadth* 3.7-4.0 mm.

KENYA: Machakos, 1 ♂, 1 ♀, xi. 1923 (*Dr. V. G. L. van Someren*); Kitui, 4 ♂, 3 ♀, x. 1937 (*R. Toker*), 1 ♀, xi. 1933 (*McArthur*); Mwingi, Kitui, 1 ♂, xi. 1940 (*T. H. E. Jackson*—type).

A very distinct species in both sexes.

9. *Polyclæis pubicollis*, sp. n.

♂. Derm black to piceous, with long soft erect hairs on the dorsum, those on the pronotum being shorter and denser; prothorax with a broad lateral stripe of yellow powder; elytra with pale markings of the *longicornis* pattern, the post-humeral band extending inwards to stria 4 or even 3, usually broad, but sometimes narrower and even interrupted, the rest of the surface with sparse minute recumbent grey setæ in addition to the erect hairs; underside rather thinly setose throughout.

Head and rostrum longitudinally striolate; frons flat, its width greater than the length of an eye; eyes strongly convex. *Antennæ* rather short, blackish, the scape and proximal joints of the funicle more or less reddish, the two basal joints equal. *Prothorax* somewhat transverse (6:7), gently rounded laterally, widest at about the middle, the apex constricted and a little narrower than the base, the basal angles rectangular, dorsum opaque, with coarse close transversely confluent punctures, appearing carinulate, the transverse basal depression shallow. *Elytra* parallel from the shoulders to two-thirds, with a short apical mucro; the shallow striæ with strong close punctures that diminish greatly behind, the intervals with very shallow fine punctures, becoming rugulose behind and granulate on the apical margin; the pale discal spots formed of long white setæ. *Legs* red, with the apex of the femora, the underside of the front femora, the front tibiæ and the tarsi, blackish, clothed only with more or less erect pale setæ; the mucro on the front tibiæ small and sharp, the hind tibiæ almost straight, the setæ on the inside no denser than those on the outside.

♀. Somewhat similar in appearance to the ♂, but the upper surface clothed with rather narrow yellowish scales without any erect hairs; the lateral stripes on the prothorax formed of narrow white scales and recumbent setæ, the disk with fairly even sparse narrow yellowish scales; elytra with the *longicornis* pattern formed of dense narrow white scales, the post-humeral band narrow and macular, reaching stria 4 but not extending forwards along the lateral margin; metasternum with fairly dense white scales and setæ laterally, the venter setose. The prothorax

longer and narrower than in ♂, 'being almost as long as broad; the legs with the fuscous markings much reduced or absent.

Length 9.0–10.5 mm., *breadth* 3.5–4.0 mm.

TANGANYIKA: Usangu dist., 3500–4500 ft., 3 ♂, xi–xii. 1910 (*Dr. S. A. Neave*); Lulanguru, 1 ♂, 1 ♀, x.–xi. 1917 (*Dr. G. D. Hale Carpenter*); Ndala Mission, Tabora dist., 1 ♂, xii. 1916–i. 1917 (*G. D. H. C.*); Msagaa, E. of Singida, 1 ♂, x.–xii. 1935 (*E. Burt*).

10. *Polyclæis opiko*, sp. n.

♂. Derm black, without any erect hairs, the general clothing formed of sparse pale brown setæ; the lateral stripes on the prothorax made of dense yellowish setæ, as are the *longicornis*-like markings on the elytra, the post-humeral band broad, extending inwards to stria 4 and there produced a little backwards and sometimes uniting with the postmedian discal spot, the posterior lateral spot very elongate, underside setose throughout.

Head and *prothorax* as in *pubicollis*, sp. n. (apart from the clothing). *Antennæ* a little stouter, with the joints slightly shorter. *Elytra* slightly widened behind the shoulders and subparallel to beyond the middle, the apical mucro short; the shallowly impressed striae with close strong punctures that diminish behind, the intervals rugulose throughout; the pale discal spots formed of narrow, sharply acuminate scales. *Legs* red, the apex of the femora and the lower surface of the front pair blackish, the tarsi and front tibiae sometimes blackish; tibiae with no erect setæ on the upper or outer faces, the hind pair almost straight and with sparse erect setæ on the inner face.

Length 10.0–10.5 mm., *breadth* 3.5–3.7 mm.

KENYA: Nyando R., Opiko, 3 ♂, iv. 1945; Kisumu, 1 ♂, iii. 1936 (*H. J. Allen Turner*).

Superficially very similar to *pubicollis*, sp. n., from Tanganyika, but with quite different clothing.

11. *Polyclæis carpenteri*, sp. n.

♂. Derm black, without erect hairs, the general clothing consisting of fairly dense narrow pale brownish scales;

prothorax with the lateral stripes formed of dense broader scales, and similar scales often scattered on the disk, especially along the middle line; elytra with the usual yellowish *longicornis* pattern, but the post-humeral band, which reaches stria 4 and sometimes beyond 3, varies from broad to narrow and submacular, and occasionally it does not extend along the margin towards the base; metasternum with mixed scales and setæ laterally, the venter setose only.

Head and rostrum with coarse, longitudinally confluent punctures; frons wider than the length of an eye, shallowly depressed; eyes strongly convex. *Antennæ* piceous, short; funicle with the two basal joints subequal, 5-7 transverse. *Prothorax* somewhat transverse (6:7), more distinctly rounded laterally than in other species, widest at middle, shallowly constricted at the apex which is somewhat narrower than the base, the basal angles rectangular; dorsum opaque, with coarse close transversely confluent punctures, the transverse basal depression shallow. *Elytra* parallel from the shoulders to two-thirds, the apical mucro turned upwards; the striae with strong close punctures diminishing behind, the intervals rugose throughout; the pale spots on the disk formed of normal ovate scales that are not sharply acuminate at the apex. *Legs* red, with the apex of the femora, the underside of the front pair, the tarsi, and often the front tibiae, blackish, clothed with comparatively dense pale setiform scales and setæ; tibiae without erect setæ except a few on the inner face of the hind pair.

♀. Very similar to ♂, except that the pale markings are much more reduced and the scales on the elytra are larger; the antennæ are somewhat shorter; the sides of the prothorax are less rounded and almost parallel in the basal half.

Length 11.0-12.5 mm., breadth 4-5 mm.

UGANDA: Madi, 3 ♀, v. 1927 (*Dr. G. D. Hale Carpenter*); Bunyoro, 10 ♂, v. 1928 (*G. D. H. C.*); Kaiso, Lake Albert, 1 ♂, iv. 1928 (*E. B. Worthington*).

This species is remarkable in that the discal spots on the elytra of the male are formed of normal scales just like those of the female, and they evidently do not bear the usual yellow powder.

12. *Polyclæis dollmani*, sp. n.

♀. Derm black, with small oval whitish or yellowish scales; head and rostrum with fairly dense scales and recumbent white setæ; prothorax with broad lateral stripes of dense whitish scales, the disk unevenly scattered with scales and short setæ; elytra with white scales forming a *longicornis* pattern, but with the markings much broader than usual and rather ill-defined, the post-humeral band extending brokenly right up to the suture (though sometimes interrupted on interval 4) and having always a short projection on its hind margin on interval 7, the remaining areas with scattered similar scales which are denser at the base and apex; metasternum with rather dense scaling laterally, and a few scales towards the sides of the two basal ventrites.

Head with coarse punctures that are more or less confluent longitudinally; frons usually rather deeply depressed (but almost flat in one case), its width a little greater than the length of an eye; eyes strongly convex. *Antennæ* red-brown, moderately long; funicle with the two basal joints equal or 1 slightly longer than 2, the distal joints not transverse. *Prothorax* somewhat transverse (8:9), with the sides more or less parallel in the basal half and narrowing in a curve to the constricted apex, the basal angles rectangular; dorsum opaque, with very coarse, transversely confluent punctures, the transverse basal depression broad and deep, and the anterior half more or less impressed on the disk, forming a low transverse median elevation. *Elytra* parallel from the shoulders to two-thirds, the apical mucro very small; the striae with deep close punctures that diminish behind, the intervals finely rugulose throughout. *Legs* red-brown, with numerous broad scales among the setæ.

Length 10.0–11.5, *breadth* 3.6–4.1 mm.

N.W. RHODESIA: Broken Hill, 6 ♀, xi. 1914 (type); Mwingwa, 1 ♀, xi. 1913 (*H. C. Dollman*).

A distinctly-marked species, and judging by its nearest ally, *carpenteri*, sp. n., the male will probably not be very different from the female.

13. *Polyclæis maculatus* Boh.

This species was originally described from the Anglo-Egyptian Sudan, and so far all the typical specimens

have come only from that country. From the series available the species seems to be very stable, but unfortunately all the specimens happen to be males. Judging by the most nearly allied forms, the females will probably prove to be very similar to the males, except that all the clothing of the elytra may be squamose instead of setose.

P. maculatus ugandanus, sp. n.

This more southern race can be distinguished externally by the great reduction of the post-humeral yellow band, which extends inwards only to stria 8, instead of to 4; and in one specimen the whole subhumeral marking is reduced to three small isolated spots. The male aedeagus is also distinctly more pointed at the apex.

UGANDA: Madi, 2 ♂, v. 1927 (*Dr. G. D. Hale Carpenter*).

P. maculatus acuminatus, sp. n.

♂. General colouring much more blue than in *m. maculatus*. Elytra more acuminate apically, beginning to narrow at or before the middle, the setae broader. Clothing of the head below the eyes formed of long narrow scales (entirely setose in *maculatus*). The apical thickening of the aedeagus twice as large as in *maculatus*.

♀. General clothing consisting of very small ovate blue scales, which vary in width in different individuals. Elytra less acuminate apically than in ♂, with a smaller apical tuft. Funicle with joint 1 a little longer than 2 (equal in ♂). Metasternum with small ovate scales in the middle (setose in ♂).

Length 16.5–21.5 mm., breadth 6.5–8.0 mm.

KENYA: Undurugo, 2 ♂, 1 ♀, xi. 1911 (*R. L. Scott*—type); Nengia, 2 ♂, 3 ♀; Nziu R., 1 ♂, vii. 1929 (*Dr. V. G. L. van Someren*).

14. *Polycelis reductus*, sp. n.

♂. Derm black, without erect hairs dorsally; general clothing consisting of fairly dense, pale blue setae; prothorax with a broad yellow lateral stripe; elytra with the *longicornis* pattern very greatly reduced, the anterior marginal stripe of the usual length but not produced inwards behind the shoulder, where it does not even reach stria 9, the postmedian discal spot normal, and the

posterior lateral spot entirely absent; underside setose throughout.

Head with rather close shallow punctures; frons wider than the length of an eye, only shallowly depressed; eyes moderately convex. *Antennæ* black, the two basal joints of the funicle equal. *Prothorax* moderately transverse (11.15), widest at the base, with the angles slightly and sharply projecting, very gradually narrowing to the middle and then slightly curving inwards to the apex, which is not constricted; dorsum with close shallow punctures that are mostly transversely confluent, the transverse basal depression deep. *Elytra* ovate, the apical mucros obtuse, with a dense tuft of setæ, the striæ shallow, with rather small close punctures that greatly diminish behind, the intervals finely granulate; the discal yellow spot formed of fine yellow setæ with a metallic dilatation at the base. *Legs* black, with pale blue setæ; femora with a dense fringe of erect setæ on the lower face; tibiæ with long erect setæ on all sides, those on the inner face of the hind tibiæ as sparse as the others, 2nd tarsal joint a little broader than long.

♀. Very similar to ♂. *Elytra* clothed with shorter grey or blue setæ or narrow scales; underside entirely setose.

Head with the eyes less convex. *Prothorax* slightly more transverse, the basal angles not projecting. *Elytra* with the striæ slightly more impressed, the apical tufts much shorter, and the discal pale spot formed of translucent pale yellow oblong scales. *Legs* with the second tarsal joint as long as or slightly longer than broad; femora without any fringe beneath.

Length 13.5-16.0 mm., breadth 5.4-6.0 mm.

TANGANYIKA: Usangu dist., 3500-4500 ft., 1 ♂, 2 ♀, xii. 1910 (Dr. S. A. Neave).

15. *Polyclæis auriventris* Chev.

♂. Derm black, without erect hairs dorsally; head, rostrum and prothorax with greenish setæ and scattered green or coppery scales, without any pale lateral stripe on the prothorax; scutellum with similar dense scales; elytra with dense uniform narrow green scales that taper into a grey seta at their apex, without any markings; metasternum with numerous coppery scales which also extend along the whole side of the venter, mixed with setæ.

Head with shallow separated punctures; frons as wide as the length of an eye, varying from almost flat to deeply depressed; eyes moderately convex. *Antennæ* black, funicle with joint 2 equal to or slightly longer than 1. *Prothorax* moderately transverse, widest at the base, slightly rounded laterally, shallowly constricted at the apex, with the basal angles projecting sharply backwards; dorsum with fine separated punctures, the transverse basal depression deep. *Elytra* ovate, widest before the middle and somewhat acuminate behind, the apical mucros rather large and stout; the striae impressed and the punctures largely concealed by the clothing, the convex intervals densely punctate. *Legs* black, with fairly dense grey setæ and coppery scales; hind tibiae nearly straight and with only a few erect setæ on the inner face, 2nd tarsal joint transverse.

♀. Derm black, with fairly dense pale brown oval scales (rarely with a coppery reflection) and scattered whitish ones which usually form an indefinite postmedian spot near the suture. underside with dense pale scales throughout. Frons only shallowly depressed; eyes less convex. Prothorax with the sides rather more straight, the basal angles produced slightly outwards. Elytra a little broader, less pointed behind. Second tarsal joint as long as or longer than broad.

Length 16.0–18.5 mm., breadth 5.6–7.0 mm.

TANGANYIKA: Ukami Mts., 1 ♂; Dar-es-Salaam, 1 ♀; near Kilossa, Usagara dist., 1500–2500 ft., 13 ♂, 11 ♀, xii. 1910 (*Dr. S. A. Neave*).

South of the Zambesi this species is represented by *sumptuosus* Pér. To the north, in Kenya, there is a local form, which seems extremely similar in the female sex but differs consistently in the male, as indicated below, though there is no difference in the sœdeagus.

P. auriventris oblitus, sp. n.

♂. Differs from that of the typical form in that the head, rostrum and pronotum bear no broad scales, or at most very few. The setæ on the pronotum are much less dense on the disk, while at the sides there is a distinct broad stripe formed of very dense setæ; the scutellum bears only sparse setæ. On the elytra the setæ are much narrower and less dense, and there are very indefinite,

pale greenish or yellow markings recalling the *longicornis* pattern, the postmedian juxta-sutural spot being the most prominent; these markings are formed of broader setiform scales. There are no broad scales on the last three ventrites and only a few towards the sides of the other two.

♀. Only distinguishable from the typical form by the characters given in the key.

KENYA: Machakos, 13 ♂, 10 ♀, xi. 1923 (*Dr. V. G. L. van Someren*—type); Thika, 1 ♀, xi. 1926, 1 ♂, xi. 1928 (*A. F. J. Gedyé*); Laitokitok, 1 ♂, xi. 1931 (*C. B. Symes*); Kitui Boma, 1 ♂, xi. 1933 (*McArthur*); Ruiru, 2 ♂, vi. 1937 (*A. F. J. G.*); Nengia, 8 ♂, 14 ♀ (Glasgow Univ. Mus.).

16. *Polyclæsis macrops*, sp. n.

♂. Derm black, shiny, the background almost bare in the typical form (from Kitui); head and rostrum sparsely setose and with a few small pale scales; prothorax bare on the disk, with a very broad yellow lateral stripe enclosing a round bare spot; elytra with the following markings of grey pubescence covered with yellow powder:—a long stripe on interval 4 (partly encroaching on 3 or 5) from close to the base to far behind the middle, followed by a subapical spot with which it sometimes unites; a broad marginal stripe from the base nearly to the apex, usually broadly interrupted at about the middle, and emitting a spur before the middle which usually reaches interval 6 but may reach the dorsal stripe; finally a few whitish scales along the basal margin; underside with yellowish scaling along the sides and a broad darker median stripe clothed with setæ only. The specimens from Maktau differ in having small whitish scales along the striae on the elytra and along the base of the pronotum; the underside is much more densely squamose and the median setose stripe narrower.

Head with fine obsolescent punctures, the frons shallowly depressed, unusually narrow, its width being only half the length of an eye or slightly more; eyes very large, almost flat, not exceeding the line of the temples, nearly as long as the rostrum. *Antennæ* short, with the two basal joints of the funicle equal. *Prothorax* subconical, widest at the base, with the sides straight or very slightly curved, the basal angles acute but not produced laterally; dorsum with fine obsolescent punctures and sometimes with a

shallow median stria, the transverse basal impression feeble or absent. *Scutellum* with dense whitish scales. *Elytra* narrowly ovate, widest at a little behind the shoulders and gradually narrowing behind, with a short sharp apical process; the striae impressed, especially towards the apex, with strong close punctures that are much smaller behind, the intervals slightly convex, about as wide as the striae on the basal half, and with fine evanescent punctures. *Legs* red-brown, with the tarsi and sometimes the knees blackish; tibiae without erect setae, except a few on the inner face, the hind pair straight.

Length 9.0–11.5 mm., *breadth* 3.0–4.5 mm.

♀. *Derm* black; *prothorax* with small brownish (rarely whitish) ovate scales, which are rather sparse on the disk and denser laterally, but without any lateral yellow stripe; *elytra* with similar scales which are dense in the striae and much sparser on the intervals, producing an unusual and characteristic striped appearance, the marginal yellow stripe much as in ♂ but not extending so far apically and not produced inwards beyond stria 8, underside densely squamose, the broad median dark stripe bare but sparsely setose on the last three ventrites.

Structurally quite similar to ♂.

Length 12.5–15.0 mm., *breadth* 4.7–5.5 mm.

KENYA: Kitui, 4 ♂, 8 ♀, x. 1937 (*R. Toker*—type); Maktau, 6 ♂, xii. 1936 (*MacArthur*).

A very distinct species in both sexes on account of its colouring, very large eyes, and exceptionally narrow frons.

XXVIII.—Notes on some Ordovician Brachiopods and a Trilobite from the Balclatchie Beds of Girvan. By F. R. C. REED, M.A., Sc.D., F.G.S.

[Plate I.]

Orthis (Glyptorthis) biornata, sp. nov.
(Pl. I. fig. 5.)

Holotype (B.G. 11716). Shell transversely subelliptical, hinge-line rather less than width of shell; cardinal angles obtuse. Surface of brachial valve uniformly convex, without fold or sinus, ornamented

with about thirty strong, straight, equal and equidistant subquadrate simple ribs, becoming rather smaller near the hinge-line: interspaces rounded or subquadrate and equal in size to the ribs, all bearing four or five fine radial striæ and crossed in outer two-thirds of valve by numerous concentric imbricating lamellæ of rather unequal strength but mostly equidistant.

Dimensions. —

	mm.
Length	12.0
Height	18.5

Remarks. — There is one example of this new species in Mr. Begg's recent collection from Balclatchie consisting of the impression of the exterior of a brachial valve. It has much the appearance of *O. (Glyptorthis) crispa* McCoy, which has been described from the Starfish Bed (Reed, 1917, p. 842, pl. viii. figs. 3-7) and *O. (Gl.) balclatchiensis* Dav. (Reed, 1917, p. 840, pl. vii. figs. 13-20), but it differs from the former in the ribs being more subquadrate and simple instead of angular and bifurcated or even trifurcated, and in the possession of fine radial striæ such as are found in *O. duftonensis* Reed, var. (Reed, 1917, pl. v. fig. 40) from Balclatchie, which, however, differs in other respects.

Actinomena brumalis (Reed).

The species from the Balclatchie Beds which the author described as *Rafinesquina ? brumalis* (1917, p. 870, pl. xii. figs. 21-24) is put by Opik (1930, p. 166) in his subgenus *Actinomena* of *Strophomena*, but it seems to merit generic rank. *Raf. subarachnoidea* Reed (1917, p. 870, pl. xii. figs. 25-30, non 31) is also put by him in the same genus, but one specimen which was included by the present author (*op. cit.* pl. xii. fig. 31) under this name should be referred to the genus *Ptychoglyptus* and is almost identical with *Pt. subcorrugatellus* (Reed), which was mistakenly placed (1917, p. 886, pl. xv. figs. 33, 34) in the genus *Plectambonites*. There are several examples of *Actinomena brumalis* (B.G. 11734, 11747) in Mr. Begg's present collection, and the allied species *A. subarachnoidea* (*sens. restr.*) is also represented (B.G. 11755). A specimen from the Ordovician of the Southern Shan States (Reed, 1936, p. 36, pl. iii. fig. 5) has been compared with the last-mentioned species.

Playfairia girvanensis, sp. nov.

It was pointed out by Öpik (1930, p. 182) that the shells from the Balclatchie Beds and the Craighoad Limestone which the present author (1917, p. 866, pl. xi. figs. 21-30) had referred to *Rafinesquina deltoidea* (Conr.) could not belong to that species. Salmon has recently (1943, p. 571) maintained the same view.

Those Girvan specimens were chosen clearly as the type of a new subgenus which was named *Playfairia*, and as they can no longer be regarded as belonging to *R. deltoidea* the specific name *girvanensis* has been suggested for them (1933, MS.). It is an abundant form in the Balclatchie Beds and the figures given by the author well illustrate the external and internal characters of both valves (1917, pl. xi. figs. 21-26, 28-30, non 27). Examples in the present collection (B.G. 11725, 11742) from Balclatchie afford no further details of the species, but as it was not clearly defined the following definition is here given.

Shell transversely subtriangular, rounded, widest along the hinge-line, cardinal angles less than right angles, subacute. Pedicle-valve with gently convex or somewhat flattened large disc occupying about three-fourths the length of the valve, the marginal fourth of which is arched down rather suddenly but rounded and not abruptly or angularly geniculated; umbo small, inconspicuous, scarcely rising above the hinge-line, interior of the valve with short subflabellate, triangular, slightly divergent diductor muscle-scars about one-fourth the length of the valve, strongly impressed, radially ridged and obscurely bilobate; vascular sinuses forming one main median pair arising from between the diductors and running forwards divergently or subparallel towards the anterior margin; lateral vascular sinuses usually irregular or absent; teeth very small. Surface of valve marked with numerous fine subequidistant, radial lines with 4-6 finer lines in the interspaces; 2-4 short transverse rugæ at right angles to the hinge-line on each side of the umbo but nearer the cardinal angles.

Interior of the brachial valve having muscle-scar composed of two pairs of adductor scars, of which the posterior pair is short and subflabellate and the anterior pair narrower, elongate and subrhomboidal.

The typical *Rafinesquina deltoidea* as figured by Hall & Clarke (1892, pl. ix. A. fig. 4), and stated to be from the original specimen used by Conrad, is represented in the present collection by one nearly complete specimen (B.G. 11748) from Balolatchie, measuring 21 mm. in length and 20 mm. in width along the hinge-line.

Salmon (1943, p. 583, pl. lxviii. figs. 16-20) has given an amended definition of Conrad's species and has considered that Davidson (1871, p. 292, pl. xlii. figs. 1-5, pl. xxxix. fig. 22, 1883, p. 197, pl. xv. figs. 16-32) wrongly identified British specimens with it, which according to this author (1942, p. 583) belong to the new genus *Opikina*. The Girvan specimens referred by the present writer to *R. (Playfairia) deltoidea* are likewise rejected. We may note that Endo (1932, p. 46, pl. ii. figs. 4-6) described an Ordovician species from Manchuria as *Playfairia* cf. *deltoidea*. It is difficult to agree with Salmon that the subgeneric name *Playfairia* (not *Playfairea* as mis spelt by Salmon) should be substituted for Bancroft's *Kjaerina* and *Hedströmina*, and that a new generic name should be found for the Girvan shells.

Ptychoglyptus pauciradiatus Reed.

This species, which was founded on a specimen from the Hovin Sandstone of the Oslo region (Reed, 1932, p. 122, pl. xviii. figs. 1, 2), is represented by one impression of a nearly perfect valve (B.G. 11743) from Balolatchie in Mr. Begg's collection, and one perfect example in Mrs. Gray's collection in the British Museum (B.B. 6106) has been figured by the author from the same horizon (1940, p. 154, pl. viii. fig. 3)

Dimensions.—

	mm.
Length	10
Width	19

Plectambonites præteritus, sp. nov.

(Pl. I. fig. 4)

There is one impression of a small transverse semi-elliptical brachial valve (B.G. 11726), very gently concave, widest along the hinge line, with cardinal angles rather less than right angles. Its surface is marked by five widely spaced equidistant radial lines, of which one is median, and the interspaces seem to be slightly concave, especially the pair bounding the median line; the whole

surface of the shell is also crossed by numerous, continuous fine regular concentric linear wrinkles. The umbonal region seems to be somewhat swollen, as it is represented in the impression as a subcircular cicatrix more than one-third the length of the valve, but this appearance may be due to injury.

Dimensions.—

Length	mm.
Width	3.25
	4.70

Remarks.—In the shape and number of radial lines it resembles *Sowerbyella* ? *quincocostata* (McCoy), the precise generic reference of which is doubtful (Jones, 1928, p. 452), but the regular fine concentric wrinkles distinguish it, as well as the gently concave interspaces, such as are found in *S. undulata* (Salter) (Jones, 1928, p. 452, pl. xxiv. figs. 1-6), to which O. T. Jones refers some of the shells put by previous authors in McCoy's species. But the concentric wrinkles, few radial lines and general characters ally it more with *Plectambonites aranea* Opik (1933, p. 14, t. 1 figs. 1-6), to which genus (in Opik's restricted sense) our specimen may be referred.

Bimuria perrugata, sp. nov.
(Pl. I. figs. 1-3.)

Holotype B.G. 11754. Shell concavo-convex, transversely semielliptical, widest along the hinge-line, with cardinal angles slightly produced, subauriculate, acutely pointed. Brachial valve concave, with narrow linear hinge-area of uniform width. Surface of valve covered with numerous thick, concentric, thread-like lines, mostly of equal or subequal size and usually regularly spaced, occasionally swelling out slightly and bifurcating; a small subumbonal swelling is generally present. Pedicle-valve strongly convex in an antero-posterior direction with rather large triangular hinge-area nearly at right angles to that of the brachial valve, and having median triangular delthyrium. There are traces of minute denticulation along the hinge-line. Internal characters are unknown.

Dimensions.—

Length	mm.
Width along the hinge-line	5.0
	7.0

Horizon and locality. Upper Caradoc, Balclatchie Group, Balclatchie Bridge, near Girvan.

Remarks. - The specimen on which this species is founded consists of the impression of the exterior of a brachial valve with the hinge-area and part of shell of the pedicle-valve attached. Other specimens (B.G. 11874, 11729) of this new species occur in Mr. Begg's collection. The transverse shape and peculiar ornamentation of the shell distinguish it from the typical *Christiania tenuicincta* (McCoy) and it most nearly resembles the species *Bimuria superba* Ulrich & Cooper (1942, p. 623, p. xc. figs. 13-18) from the Upper Lenoir formation of Tennessee, which is the genotype of *Bimuria*. The genus includes *Christiania lamellosa* Bassler and *Leptæna youngiana* Davidson from the Craighead Limestone and Balclatchie Beds of Girvan (Reed, 1917, p. 889, pl. xvi. figs. 14-18). One specimen which Davidson figured (1871, pl. xlvii. figs. 7, 7 a) as *Leptæna tenuicincta* McCoy bears a considerable external resemblance to the present Balclatchie specimen, and it is probable that the shell from the Ordovician of the Southern Shan States, described (Reed, 1936, p. 198, pl. iii. fig. 16) as *Petroria cf. rugosa* Wilson is allied and should be put in the same genus *Bimuria*.

Family Phacopidæ.

Phacops (Calliops) jukesii Salter, var. nov. *vicina*.
(Pl. I. fig. 6.)

There is one nearly complete head-shield (B.G. 11768) from the Balclatchie beds in Mr. Begg's recent collection which agrees in particular, except in the larger eyes, with *Ph. jukesii* Salter (1864, p. 36, pl. i. fig. 29) from Gelligrin, near Bala, put by Salter in the genus *Chasmops* McCoy, which Delo (1935, p. 416) included in the subfamily Pterygomelopinae. Of the genera which Delo refers to this subfamily, *Ph. jukesii* belongs to the genus *Calliops* Delo (1935, p. 417, text-figs. 42, 43) rather than to *Pterygomelopus* (sens. str.). The genotype of *Calliops* is *Phacops callicephalus* Hall, of the Trenton of America, which is allied to Salter's species, but the former has only a granulated test. The tubercles on the frontal lobe of the glabella of our Girvan head-shield are coarse and tend also to be arranged in radial lines. The narrow transverse

basal segment of the glabella swells up into small tubercular lobes on each side. These are small differences from the typical *Ph. jukesi*, but sufficient to mark a variety.

Dimensions. —

	mm.
Length of head-shield	9.0
Width of head-shield	18.0
Length of glabella	6.5
Width of frontal lobe	10.0

[*Note.*—Since the above went to press a paper by Miss A. E. Wilson entitled "*Rafinesquina* and its homomorphs, *Öpikina* and *Öpikinella*" has appeared (Trans. R. Soc. Canada, ser. 3, vol. 38, sect. iv. 1944, pp. 145–203, pls. i., ii.) by which the relation of her new genus *Öpikinella* with *Playfairia* seems to be very close.]

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EXPLANATION OF THE PLATE.

(All the specimens are in the Begg Collection.)

- Fig. 1. *Bimuria perrugata*, sp. nov. Holotype B.G. 11754. Impression of exterior of brachial valve with the hinge-area of the pedicle-valve attached. $\times 5$.
 Fig. 2. Ditto. Brachial valve with acute cardinal angles well preserved. B.G. 11874. $\times 3$.
 Fig. 3. Ditto. Brachial valve with somewhat stronger concentric ridges. B.G. 11729. $\times 2$.
 Fig. 4. *Plectambonites pateritus*, sp. nov. Holotype B.G. 11726. $\times 8$.
 Fig. 5. *Orthis (Glyptorthis) biornata*, sp. nov. Holotype B.G. 11716. Impression of exterior of brachial valve. $\times 3$.
 Fig. 6. *Phacops (Calliops) jukes* Salter, var. nov. *vicina*. Holotype B.G. 11768. Head-shield with left cheek missing. $\times 2$.

To Mr. A. Ferguson I am indebted for the excellent photographs. All the specimens are from the Balclatchie Beds, Girvan.

XXIX.—*Notes on Polychæta from the Coast of Western Canada.*—III. *Further notes on Syllidæ and some Observations on other Polychæta errantia.* By E. and C. BERKELEY, Pacific Biological Station, Nanaimo, B.C.

INTRODUCTION.

In Part II. of this series (Berkeley, E. & C., 1938, p. 33) we recorded thirteen species of Syllidæ new to the coast of western Canada, and made some comments on species belonging to that family which had been recorded there previously. Recent work makes it necessary to add another species, which we believe to be undescribed, to the family, and to make some further comments on others.

During the last few years we have revised our collections from this coast and some newly collected material has been examined. The work has brought to light some new species and several new records in many of the families other than Syllidæ, and has indicated that modifications and amendments are necessary in cases of species previously recorded. The greater part of the present paper consists of these records and amendments.

The types of the new species are in the authors' collection.

Syllis hyalina Grube.

Fauvel, 1923, p. 264. Berkeley, E. and C., 1941, p. 29.

This species has not been recorded previously from the coast north of California. We now find that it occurs commonly, together with *S. sclerolæma* Ehlers (see Berkeley, E. & C., 1938, p. 40), in the sponge which coats the shells of *Pecten hindsii* dredged in 30 to 50 fathoms in Northumberland Channel in the Nanaimo region.

Syllis harti Berkeley.

Berkeley, E. and C., 1938, p. 35.

The distribution of this species is extended from the west to the east coast of Vancouver Island. Dredged in Nanoose Bay in about 15 fathoms.

Eusyllis blomstrandii Malmgren.

Fauvel, 1923, p. 293.

This is the first record of the species from the west coast of North America. It has been found, together with *Syllis sclerolæma* and *Syllis hyalina*, in sponges coating *Pecten hindsii*, dredged in 25 to 30 fathoms in Northumberland Channel in the Nanaimo region. It has also been taken in 100 fathoms in Bayne's Sound, near Comox, Vancouver Island.

The specimens agree with Fauvel's description, except that the dorsal cirri are definitely articulated throughout the body and that there are one or two compound setæ with long straight bifid end-pieces in each parapodium, together with those with short end-pieces which Fauvel mentions. Those taken from sponge were coloured a brilliant scarlet due to eggs.

Hesperalia, sp. ?

Chamberlin, 1919, p. 8.

A single specimen found on a piece of wood taken in the dredge in Northumberland Channel, near Nanaimo, in 25 to 30 fathoms, agrees in all the main characteristics of this genus. No representative of it appears to have been recorded since Chamberlin's original description of two species from Laguna Beach, California, in 1919. Our specimen differs from the genus as defined in that

there are two flaps, one slightly behind the other, extending from the anterior edge of the peristomium over the posterior part of the prostomium, instead of only one. In this respect, and in details of coloration, it differs from *H. californiensis* Chamberlin, but it comes very near that species in all other particulars. The specimen is not well preserved and we prefer to leave it unnamed until we have more and better material.

Autolytus magnus Berkeley, *Polybostrichus* phase.

Berkeley, E. and C., 1938, p. 47

Only a single specimen of the male form of this species has been recorded hitherto, but it does not seem to occur as rarely as had been thought. We have now found several specimens in material collected by workers at the Biological Station, Nanaimo, in past years; notably by Dr. Neal Carter off Cape Mudge, east coast of Vancouver Island, in 1930, and by Mr. G. H. Wailes in Departure Bay, Nanaimo, in 1928. In both cases the material was collected in the surface tow-net. The size of the specimens is very variable, some being no more than 5 or 6 mm. in length. In others the length approximates to that of the specimen first recorded (38 mm.). The majority are about 25 mm. long. Some of the examples are almost colourless, others have touches of pigment on the cirri and on the dorsum. In some there are transverse lines of pigment across the dorsum. The atokous form of this species is still unknown.

Autolytus trilineatus, sp. n.

All, except two, of the specimens of this species are in the atokous form. Several of them show signs of bud formation. Two complete individuals measure about 20 mm. for 84 and 85 setigers respectively.

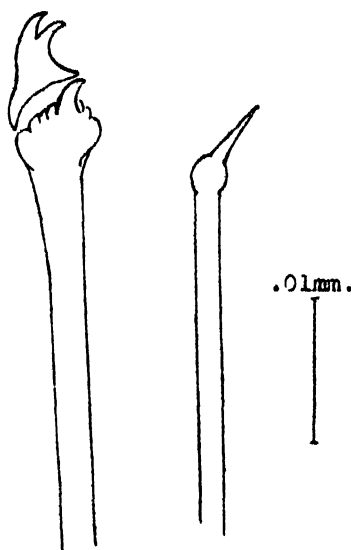
The general body-colour is a creamy white. Typical colour markings are very definite and conspicuous, consisting of three longitudinal broad dark brown bands running the whole length of the dorsum, but in some cases the bands are represented by no more than fine dots and bars.

The prostomium is rounded in front and slightly longer than broad. The two pairs of eyes are reddish, the

anterior pair only slightly larger than the posterior. The median tentacle is as long as the first eight segments, the laterals and the dorsal tentacular cirri half as long. The ventral tentacular cirri are about a third the length of the dorsal ones. The dorsal cirrus of the first parapodium is as long as the median tentacle, that of the second parapodium only a quarter of that length. All these appendages are smooth and are slightly articulated

Fig. 1 a.

Fig. 1 b.



Autolytus trilineatus, sp. n.

1 a. Compound seta.

1 b. Bayonet seta.

noly in contraction. They all have a touch of dark pigment at their tips.

The pharynx makes an S-curve between the proventriculus and the mouth and has ten large and equal teeth. The typical parapodium is characterised by a short smooth subulate dorsal cirrus and a bundle of compound setae with swollen ends to the shafts and

bidentate end-pieces (fig. 1 *a*). In each bundle there is one bayonet seta (fig. 1 *b*).

This is the species we previously attributed, with some hesitation, to *A. aurantiacus* (Clap.) (1938, p. 48). It resembles that species in the relative lengths of the anterior appendages, but it differs in coloration in the fact that the pharynx does not make a complete convolution, and in the number of pharyngeal teeth. In the characters of the pharynx it exactly resembles *A. prolifer* (O. F. Müller).

The examples previously recorded as *A. aurantiacus* were dredged in 10 to 15 fathoms in Departure Bay, Nanaimo. It has since been taken between Jesse Is. and Five Fingers Is. at about the same depth, and has been found living amongst sponges coating rocks exposed at a moderately low tide on Newcastle Is. These localities are all in the same region.

Two specimens, also taken in the Nanaimo region, appear to represent the polybostrichus stage of this species. They have the characteristic markings in the thoracic region and they agree in size (*i. e.*, width). There are six thoracic setigers. The median region consists of 29 setigers in one specimen, 23 in the other. The caudal region is much reduced, little more than a pygidium remaining.

Aphroditidae.

Aphrodite longipalpa Essenberg.

Essenberg, 1917, p. 403.

This species has not been recorded since it was originally described from California. Hartman (1939, p. 20) points out that Fauvel questionably referred the species to *A. talpa* Quatrefages, but she considers the identity extremely unlikely, though she is doubtful whether *A. longipalpa* should be regarded as a valid species. It seems to us to be sufficiently well characterised and the four specimens now recorded from the east coast of Vancouver Island (three north of Five Fingers Is. in 200 fathoms and one between Five Fingers Is. and Newcastle Is. in 220 fathoms) agree exactly with Essenberg's description in all particulars except that the style of the tentacle is longer than its ceratophore.

Polynoidæ.*Gattyana iphionelloides* (Johnson).

Johnson, 1901, p. 391.

Several specimens collected at low tide mark at various localities in the Nanaimo region agree closely with Johnson's description. As he indicates, the lobes of the prostomium have no well-defined peaks. In this respect the species does not conform with *Gattyana* as defined by Fauvel (1923, p. 49), but Malmgren's original definition of *Nychia*, for which the name *Gattyana* was substituted by McIntosh, makes no mention of peaks. In every other respect, including the ventral insertion of the lateral tentacles and the characters of the setæ, the species is a typical *Gattyana*.

Eunoë barbata Moore.

Moore, 1910, p. 334.

Only a single specimen of this species has been recorded previously from the coast north of California. Moore (1908, p. 334) listed it from Admiralty Inlet, Port Townsend, Washington, under the name *Harmothoë hirsuta* Johnson, but he subsequently (1910, p. 338) stated that the specimen was actually one of *Eunoë barbata*. We now extend the distribution to Berry Point, near Vancouver. A single specimen taken there agrees exactly with Moore's description.

Harmothoë lunulata (Delle Chiaje).

Fauvel, 1923, p. 70; Berkeley, E. and C., 1941, p. 21.

We recorded this species from Corona del Mar, California, in 1941. At that time this was the most northerly record of the species in the Pacific area, but we have recently examined a specimen taken off Mittelnacht Is., off the east coast of Vancouver Is., in 100 fathoms, which agrees very closely with Fauvel's description. The elytral markings are pale but distinct. Some of the neurosetæ have knobbed tips as figured by Fauvel (1923, fig. 26) for the variety *Andreapolis*, and many of the notosetæ are almost entirely smooth.

Lagisca multisetosa Moore.

Moore, 1902, p. 267, Berkeley, 1923, p. 215, Berkeley, E. and C., 1942, p. 188

This species has repeatedly been recorded from western Canada. It occurs commonly, dredged in moderate depths, off both the east and west coasts of Vancouver Is., and has been taken as far north as Dolphin and Union Strait in the western Canadian Arctic (Berkeley, E. & C., 1944, p. 2), and as far south as Lower California (Moore, 1910, p. 340).

It is included here in order to discuss a point bearing on its classification. An essential feature of *Lagisca*, as originally defined by Malmgren and since retained in the definition, is the presence of an anal region uncovered by elytra. Malmgren's definition provides for "about 10" uncovered segments, Fauvel's (1923) for "8 to 20." The only statement made by Moore, or any subsequent author, bearing on this point in relation to *Lagisca multisetosa* is that of Moore (1910, p. 340) that the body is "prolonged considerably beyond the last elytra."

Whilst this is true of the majority of our specimens, re-examination discloses that a great many of them, which agree closely in all other respects, have elytra so near the end of the body that at most only six segments are exposed, and in some cases the body is practically covered. Evidently the extent of an uncovered anal region is a more or less variable character in this species. Specimens in which this region is covered come very close to *Evannella impar* (Johnston).

Enipo cirrata Treadwell.

Treadwell, 1925, p. 1 Hartman, 1938 A, p. 120; Berkeley, E. and C., 1942, p. 188

The distribution of this species, previously known only from Alaska, is now extended to the east coast of Vancouver Is. (Maple Point, Deep Bay, in 20 fathoms). The single incomplete specimen from this locality is about 8 mm. wide over the setæ and differs from the Alaskan specimens in having a heavily pigmented prostomium. Hartman (1938, p. 120) says that no notosetæ are present in the type after the 12th segment. This is not the case in either our Alaskan or British Columbian specimen. In both of these there are at least three or four notosetæ

present as far back as the specimens extend (*i. e.*, to the 54th segment in the former case and to the 40th in the latter). The majority of the notosetæ are more curved than is shown in Hartman's figure (1938, fig. 39 *e*), except in the most posterior segments. The neurosetæ are as shown in Treadwell's figure (1925, fig. 4). The elytra agree with our previous description, but the present specimen is less extended and they overlap slightly at some points. In both the Alaskan and Canadian specimens the exposed edges of the elytra are curled upwards.

Hermadion truncata Moore.

Moore, 1902, p. 272. Berkeley, 1923, p. 215.

Moore describes the neurosetæ of this species as having the tip "smooth, long, simple, strongly hooked and sharply pointed." In many of the specimens recorded by one of us from the Nanaimo region in 1923 the neurosetæ have bidentate tips. This does not necessarily exclude classification as *Hermadion*, since well-recognised members of that genus are known to have bidentate neurosetæ, especially when young (see Benham, 1921, p. 50).

Hesperonoe complanata (Johnson).

Johnson, 1901, p. 392. Berkeley, E. and C., 1935, p. 766.

Hitherto Johnson's record from Puget Sound has been the most northerly one for this species. We now extend the distribution to Kye Bay, near Comox, east coast of Vancouver Is.

Sigalionidae.

Pholoë tuberculata Southern.

Southern, 1914, p. 57.

Pholoë minuta (Fabricius) was recorded by one of us from the Nanaimo region in 1923 (Berkeley, 1923, p. 216). Re-examination of this material, and of other specimens since collected in the same region, has disclosed characters previously overlooked, notably the presence of a well-defined facial tubercle and of two kinds of setæ in the notopodium. Southern described *Ph. tuberculata* from Clare Is. in 1914, a species characterised by these peculiarities. Our specimens agree very closely with his description, and therefore are now placed in that species.

Pholoë minuta is not known to occur on the west coast of North America south of Alaska.

Phyllodoceidae.

Phyllodoce (Anaitides) madeirensis Langerhans.

Fauvel, 1923, p. 150, Berkeley, E. and C., 1942, p. 189

Our record of this species from the west coast of Vancouver Is. in 1942 was the first of its occurrence on the west coast of North America north of California. We now extend the distribution to China Hat, Swindle Is., between Ocean Falls and Prince Rupert.

Phyllodoce (Anaitides) mucosa Oersted.

Fauvel, 1923, p. 152.

The specimens recorded by one of us (Berkeley, 1924, p. 287) from the Nanaimo region as *P. citrina* Malmgren have since been found to belong to the above species. It has been taken more recently at Mudge Is., in the same region, and off Comox Spit in 25 to 30 fathoms.

Phyllodoce (Anaitides) citrina Malmgren.

Fauvel, 1923, p. 150, Moore, 1908, p. 328.

As indicated in the foregoing paragraph, this species was recorded erroneously from the Nanaimo region in 1924. It has since been dredged in 20 fathoms in Comox Harbour. This is the first record from the coast south of Alaska.

Phyllodoce (Anaitides) maculata (Linné).

Fauvel, 1923, p. 152.

This species does not seem to have been recorded previously from the west coast of North America. It has been taken in Departure Bay and at Horsewell Point in the Nanaimo region. A specimen in poor condition dredged in Trincomali Channel in the same region is doubtfully ascribed to the species.

Phyllodoce (Genetyllis) castanea (Marenzeller).

Berkeley, E. and C., 1932, p. 312.

We recorded this species from the west coast of Vancouver Is. in 1932. We now extend the distribution

to False Narrows in the Nanaimo region. Collected on the reef at low tide.

Paranaitis polynoides (Moore).

Moore, 1909, p. 339; Berkeley, E. and C., 1942, p. 189.

The previous records of this species in western Canada were in the Nanaimo region and in the Queen Charlotte Islands. We now extend the distribution to Johnstone Strait (taken in a horizontal net haul at 100 fathoms) and to the headwaters of Princess Louise Inlet, where it was dredged in 20 fathoms.

Eteone spetsbergensis Malmgren, var. *pacifica*.

Berkeley, E. and C., 1942, p. 190 (with synonymy).

Previously recorded from the east coast of Vancouver Is. from one locality only (Piper's Lagoon, Nanaimo region), this variety is now known to be a common littoral form throughout the Nanaimo region. It has also been found as far north on that coast as Quathiaski Cove.

Eteone spetsbergensis Malmgren.

Malmgren, 1865, p. 102; McIntosh, 1908, p. 104.

Only the variety *pacifica* (see above) has hitherto been described from the coast. Two specimens having no sign of the spotted dorsum characteristic of this variety are now recorded from Lowe Inlet, Granville Channel.

Eteone longa (Fabricius).

Fauvel, 1923, p. 172.

This widespread northern species has not previously been recorded from the Pacific area south of Bering Sea. Several of the specimens in our collection are unusually long for the species, one, from Departure Bay beach, reaching a length of 160 mm. There is an occipital tubercle more or less developed in some of our specimens. In some it is a small rounded knob, in others it is represented by no more than a clear area. Otherwise they are quite typical. Treadwell (1922, p. 174) has described *Eteone tuberculata* from Friday Harbour, Washington, a neighbourhood immediately adjacent to ours. This species is characterised by the possession of a well-developed occipital tubercle and an unusual form of

peristomium, otherwise it comes very near to *E. longa*. Hartman (1936 A) records three species of *Eteone* from California which have occipital tubercles, all of which approximate to *E. longa* in some respects.

Nereidæ.

Nereis natans Hartman.

Hartman, 1936 B, p. 474.

Previously known only from the type-locality, Moss Beach, California, the distribution of this species is now extended to Gonzales Point, Victoria, B.C.

Nereis procera Ehlers.

Ehlers, 1868, p. 557

The common occurrence of this species in the Nanaimo region has already been recorded by one of us (Berkeley, 1924, p. 291). It does not appear to be represented, or is, at least, relatively rare, in material from the west coast of Vancouver Is. It is included here in order to stress a characteristic which seems to be peculiar to specimens from this coast. Moore mentions it in connection with California specimens. This is the occasional presence of one or two paragnaths representing Group 5 of the proboscideal armature. This group is usually absent in specimens taken elsewhere.

Nereis japonica Izuka.

Izuka, 1912, p. 163

One of the commonest littoral polychæta in Japan, this species has not previously been recorded from this side of the Pacific. It comes very near *N. diversicolor* O. F. Müller, of which it appears to be the Pacific prototype. Like the latter it can accommodate itself to waters of very varying salinity. The present specimens were collected at Lost Lagoon, Vancouver, a body of water of low salinity, and agree exactly with Izuka's description. The characters whereby it is differentiated from *N. diversicolor* are given in detail by the latter author.

Nephtydidæ.

Nephtys caecoides Hartman.

Hartman, 1938 B, p. 148

This is the species listed by one of us (Berkeley, 1924, p. 290) from the Nanaimo region as *N. assimilis* Oersted.

It is common throughout the region as a littoral form and has been taken in the dredge at moderate depths. The specimens agree exactly with Hartman's description, except with regard to the posterior lamella of the neuropodium, which is much longer throughout the body than as it is shown in Hartman's figures. In this respect approximation to *N. assimilis* Oersted, as shown in both Oersted's and Malmgren's figures, is close, and this led to the earlier erroneous identification. We are unable to identify these latter figures with those given by Hartman (1940, figs. 87 and 88) for a form she describes from Lower California and Guatemala under the name *N. assimilis* Oersted, and we are inclined to think she is dealing with another species.

Nephthys rubella Michaelsen.

Fauvel, 1923, p. 373

Three specimens from Mittelnacht Is., off the east coast of Vancouver Is., seem to agree with this species, of which, as far as we know, there is no American record. They are small; only about 2 cm. long. They retain a good deal of red-brown colour as preserved. Involute gills are clearly defined from the 4th setiger to the end of the body. The proboscideal characters are quite distinctive and agree exactly with Fauvel's description. The general shape of the parapodium also agrees well with the description, and the spur on the posterior lamella of the neuropodium, which characterises the species, is well defined.

Re-examination of specimens previously recorded by one of us (Berkeley, 1924, p. 290) from the Nanaimo region as *N. malmgreni* Théel has shown that these, together with a number of others since collected in the same region, have the above characters and should be classified as *N. rubella*.

Nephthys ferruginea Hartman.

Hartman, 1940, p. 241.

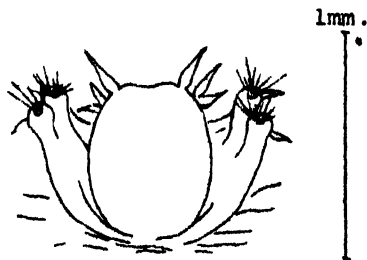
This form, previously known only from Southern California and more southerly points on the coast, was recorded as *N. caecoides* subsp. *ferruginea*. We consider it sufficiently differentiated to justify specific rank. It is common throughout the Nanaimo region, dredged in

from 15 to 75 fathoms. Specimens from this region frequently have the dorsal markings only faintly indicated or even totally absent, but there is a rather conspicuous white spot on the neuropodium throughout the body. The branchiæ are so flattened as to be almost foliaceous, and the edge of the flattened portion tends to be frilled in at least some part of the branchiferous region.

Nephthys cornuta, sp. n.

The majority of the specimens of this species come from Friday Harbour, Washington, which is just on the United States side of the international boundary. They were recorded in 1932, on the authority of one of us, as *Nephthys* sp. ? in a paper by A. O. Weese on annelids from that region (Weese, 1932, p. 18). We have now a further specimen from Princess Louise Inlet, B.C. (vertical haul from 20 fathoms).

FIG. 2.



Nephthys cornuta, sp. n. Prostomium.

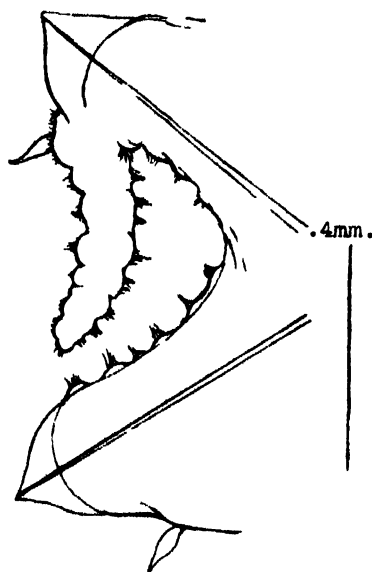
There are seven specimens from Friday Harbour, of which four are complete. Three of these measure about 10 mm., the fourth about 15 mm. All are about 2 mm. wide. They consist of 32, 35, 33 and 33 segments respectively. The specimen from Princess Louise Inlet is also complete. It is a mature female, about 16 mm. long.

The prostomium is longer than broad. There are four tentacles. The ventral one on each side is bifurcate. No eyes or nuchal organs can be made out. The

condition of the material did not admit of dissection of the proboscis. The first parapodia are carried pointing straight forward and extend as far as the anterior edge of the prostomium (fig. 2).

The parapodial rami are long and well divided. The ends of the rami are conical and the lamellæ short and inconspicuous. The branchiæ are long, straight and very slightly revolute. They begin at the 5th setiger, where they are well defined and they extend to almost the end

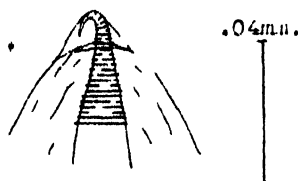
Fig. 3.

*Nephthys cornuta*, sp. n. Parapodium.

of the body. The branchia is heavily ciliated and there are patches of long cilia between the rami of the parapodium, particularly on the dorsal surface of the ventral ramus, suggesting the ctenidia in Sigalionidæ (fig. 3). The setæ are for the most part simple capillaries, some of them bristled, but barred setæ have been observed only in anterior parapodia. The aciculum is annulated towards the tip, which is fine and recurved (fig. 4). No anal cirrus has been observed.

A ciliated condition of the gills and parapodia is described in *N. buccera* Ehlers by Coonfield (1934, p. 399). This species differs from *N. cornuta* in the character of

Fig 4



Nephthys cornuta, sp. n. Tip of aciculum

the tentacles (see Ehlers, 1868, p. 617) and in the shape of the parapodium (see Coonfield, 1934, fig. 5).

Sphærodoridae.

Sphærodorum minutum Webster and Benedict.

Fauvel, 1921, p. 380. Berkeley, E. and C. 1944, p. 2

This is a new record for the west coast of North America. We have encountered the species in material taken in a horizontal net haul at Bull Harbour, Queen Charlotte Sound (depth unrecorded)

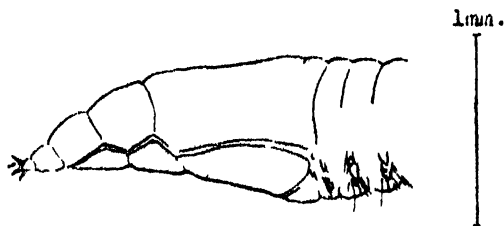
Glyceridae.

Goniada annulata Moore.

Moore, 1905, p. 549

This species was taken by the U.S. Fish Commission steamer 'Albatross' in the Gulf of Georgia, and at

Fig 5



Goniada annulata Moore. Prostomium, lateral view.

localities further north, in 1903. This is the first subsequent record north of California. Nine specimens in

our collection agree exactly with Moore's description. The species has usually been taken at considerable depths and our specimens form no exception. They were dredged in the Nanaimo region in 250 fathoms and 220 fathoms respectively. The prostomium is very characteristic. It is described by Moore, but not figured. We figure it herewith (fig. 5).

Eunicelidæ.

Onuphis conchylega Sars.

Fauvel, 1923, p. 415

Hartman (1944, p. 87) says of this species that it "has remained unreported from the temperate and tropical eastern Pacific." We had, however, recorded it from the west coast of Vancouver Is. and from Alaska in 1942. More recently (1944) we noted its occurrence in a collection from the western Canadian Arctic, and we have now found it in material collected at Namu and China Hat, on Swindle Is., between Ocean Falls and Prince Rupert, and from the Work Canal, near Prince Rupert. It seems, therefore, to be fairly widely distributed throughout the northern region of the west coast of North America.

Diopatra ornata Moore.

Moore, 1911, p. 273.

This appears to be the only representative of the genus *Diopatra* which occurs in the Nanaimo region, and we have no records of others elsewhere off the coast of western Canada. It is common on the west coast of Vancouver Is. (Berkeley, E. & C., 1942, p. 194). *Diopatra californica* Moore was reported by one of us (Berkeley, 1927, p. 408) from the Nanaimo region, but this was an error. As we pointed out in 1941 (Berkeley, E. & C., 1941, p. 36), the chief characters on which the latter species and *D. ornata* have been differentiated are very variable, and that of the comb setæ is the only entirely satisfactory differentiating criterion. On re-examining local material on this basis, no specimen of *D. californica* (which is now regarded as synonymous with *D. splendida* Kinberg; see Hartman, 1944, p. 57) has been found,

Lumbrinereis cruzensis Hartman.

Hartman, 1944, p. 165.

Several specimens dredged in fine mud in Comox Harbour and in Nanoose Bay seem to represent this species. The Nanoose specimens come within the dimensions given by Hartman, but one from Comox Harbour is considerably longer (about 70 mm.). In none of the specimens do the compound crotchets extend beyond the 13th setiger. The acicula are yellow. Hartman says that the post-setal lobe of the parapodium is longer than the pre-setal one in the posterior region of the body. We find this condition reversed in the most posterior parapodia of complete specimens, except in a few immediately preceding the pygidium. Dr. Hartman confirms this latter observation (private communication).

Lumbrinereis luti, sp. n.

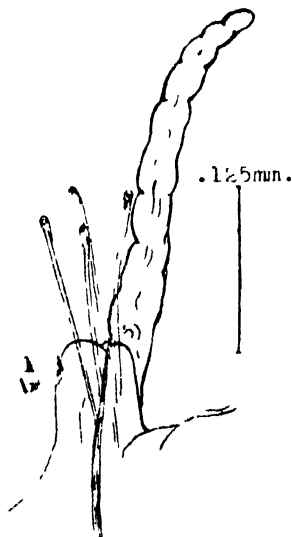
This species has been collected at Nanoose Bay and Northumberland Channel on the east coast of Vancouver Is., and at Port Alberni on the west coast; in each case in dense mud in 10 to 20 fathoms in almost oxygen-free water.

It is a very slender form, reaching 40 mm. in length, but less than 1 mm. wide. No colour remains in the preserved specimens. The prostomium is pointed. The lobes of the parapodia are like those of *L. brevicirra* Schmarda (= *L. impatiens* Claparède?) throughout the greater part of the body, but towards the anal end the posterior lobe becomes much the longer and is eventually very attenuated, whilst the anterior lobe remains inconspicuous. The long lobe is heavily supplied with blood-vessels and evidently performs a branchial function. Its presence is the most outstanding characteristic of the species (fig. 6). There are no compound crotchets. Simple ones occur from the first setiger and are much elongated in the anterior region. The acicula are light yellow. The dentition is similar to that of *L. impatiens* as described by Fauvel (1923, p. 430), except that $M3=1+2$.

The small size and the extreme elongation of the parapodial lobe in the posterior region differentiate this form from the many others which have been described with the latter character less highly developed, but these

peculiarities may be only adaptations to special environmental conditions. In this case it would represent no more than a variety of *L. brevicirra*. It also approaches *L. africana* Augener, as described by Monro from Galapagos (Monro, 1933, p. 86), assuming, as seems likely, that the extreme posterior region was lacking in his specimens.

Fig. 6.



Lumbrineris lutea, sp. n. Parapodium from anal end.

Dorvillea rudolphii (Delle Chiaje).

Fauvel, 1923, p. 446; Hartman, 1944, p. 191.

This species is now regarded as synonymous with *D. ciliata* (Keferstein), which was previously recorded from Horsewell Point in the Nanaimo region (Berkeley, 1927, p. 410). It has since been collected at False Narrows in the same region.

Dorvillea neglecta (Fauvel).

Fauvel, 1923, p. 447.

This species differs from the foregoing (*D. rudolphii*) in that forked setæ occur in all the setigers, whereas in the

type of the latter species they are replaced in the first two setigers by cultriform bristles. In some of our specimens, however, which agree completely in all other respects with *D. rudolphii*, we find that this replacement occurs in only the first setiger. Since this is the only significant point of difference between the two species (the presence, or absence, of the posterior pair of eyes is of doubtful value as a criterion of differentiation in the genus), they are both coloured orange in life, they occur together, and they approximate in size, it seems doubtful whether they should be regarded as separate species.

Collected at False Narrows Reef, Nanaimo region.

The single specimen recorded by us from Corona del Mar, California, as *D. rudolphii* (Berkeley, E. & C., 1941, p. 40) also belongs here.

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XXX. *New species of African Chrysomelidæ (Halticinae, Col.).* By G. E. BRYANT, Imperial Institute of Entomology.

ALL the types of the following new species are in the British Museum (Natural History).

Blepharidella irregularis, sp. n. (Fig. 1.)

Head and prothorax more or less fulvous, the elytra pale flavous, with an irregular brown criss-cross pattern, the legs and underside fulvous.

Length 5 mm.

Head fulvous, with a short median dark line extending from the middle to the base, a few strong scattered punctures near the inner margin of the eyes, the base impunctate. Antennæ fulvous, extending just beyond the base of the prothorax, the first segment long and dilated, the second segment very short, less than half as long as the first, the third slightly longer than the second, the fifth to the apical slightly more transverse and broader than the third and fourth. Prothorax transverse, more or less fulvous, the sides and base being slightly flavous, the sides narrowly margined, a dark punctured impression near the anterior angles, a short longitudinal impression near the basal angles, a few scattered punctures, a small round dark spot near the centre of the side-margins. Scutellum fulvous, triangular, impunctate. Elytra flavous, with an irregular brown criss-cross pattern, enclosing irregular pale patches, strongly punctate-striate, the punctures brown. Legs and underside fulvous, the posterior femora strongly punctured.

UGANDA: Entebbe, 12-20. i. 1912 (Dr. S. A. Neave), 1 specimen.

Allied to *B. holubi* Jac., but smaller, the sculpture of the prothorax different, and the pattern of the elytra more irregular.

Blepharidella variabilis, sp. n. (Fig. 2.)

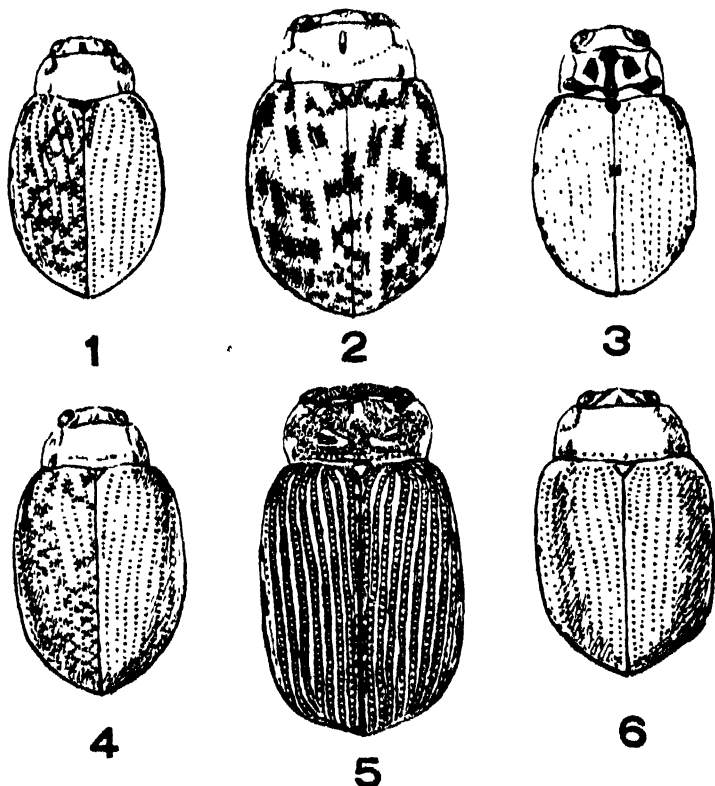
Pale flavous, the elytra with irregular black markings, the prothorax with four short deep impressions, two on

the anterior margin and two on the basal margin, and one short median impression.

Length 5 mm.

Head pale flavous, deeply impressed near the inner margin of the eyes, strongly punctured near the eyes, a

Figs. 1-6.



1. *Blepharidella irregularis*, sp. n.
2. *Blepharidella variabilis*, sp. n.
3. *Blepharidella picticollis*, sp. n.

4. *Blepharidella rubrosignata*, sp. n.
5. *Blepharidella knighti*, sp. n.
6. *Blepharidella pallida*, sp. n.

few scattered punctures on the vertex. Antennæ flavous, the first segment the longest, the remainder all about equal to each other. Prothorax pale flavous, transverse, widest at the base, the sides gradually contracted in

front, a short longitudinal punctured impression near the anterior angles and a short curved impression near the basal angles, a line of punctures extending from the middle of the side-margin to the impressed line running from the anterior margin, the surface with shallow scattered punctures. Scutellum flavous, triangular, impunctate. Elytra flavous, with an irregular black pattern, strongly punctate-striate, the black pattern on the elytra very asymmetrical. Legs flavous, the posterior femora slightly darker. Underside flavous.

NATAL : Frere, xii. 1896 (*Sir G. A. K. Marshall*), 1 specimen ; Estcourt, xii. 1892 (*Sir G. A. K. Marshall*), 2 specimens.

In the two specimens from Estcourt, the black markings on the elytra are fewer and not so irregular ; somewhat allied to *B. stolidus* Thunb.

Blepharidella picticollis, sp. n. (Fig. 3.)

Flavous, the head fulvous, the prothorax with a complicated fulvous pattern, the elytra strongly punctate-striate, the punctures fulvous.

Length 5 mm.

Head fulvous, impressed near the inner margin of the eyes and rugosely punctured, clothed with fine golden pubescence. Antennae flavous, extending slightly beyond the base of the prothorax, the first segment the longest. Prothorax transverse, the sides slightly contracted in front, flavous, with a very complicated fulvous pattern with a few scattered punctures, a median longitudinal fulvous line, expanding near the front and basal margins, a short longitudinal fulvous line near the anterior angles, extending half the length of the prothorax, a short longitudinal impression near the basal angles, and a wavy fulvous marking parallel with the basal margin. Scutellum fulvous, triangular, impunctate. Elytra flavous, strongly punctate-striate, the punctures fulvous, a small fulvous patch on the suture before the middle, six small fulvous markings along the side-margins. Legs and underside fulvous, clothed with short fine golden pubescence.

S.W. AFRICA : Okahandja, 9. ii. 1928 (*R. E. Turner*), 2 specimens.

A very distinct species on account of the well-defined pattern on the prothorax.

Blepharidella rubrosignata, sp. n. (Fig. 4.)

Pale flavous, the elytra with a reddish irregular pattern, enclosing flavous spots, the posterior femora fulvous.

Length 4-4.5 mm.

Head flavous, a few strong punctures near the base and near the inner margin of the eyes, the palpi darker and tipped with fuscous. Antennæ flavous, extending not quite to the middle of the elytra, the first segment the longest, about equal to the second and third together, the second and third about equal to each other, the fourth slightly longer than the third. Prothorax flavous, transverse, the sides widest at the base and rounded in front, a short longitudinal impression near the anterior angles, and a short longitudinal impression near the basal angles, a feeble transverse punctured impression near the basal margin, not extending to the side-margins. Scutellum fulvous, triangular, impunctate. Elytra strongly punctate-striate, flavous, with an irregular reddish pattern enclosing flavous spots. Legs flavous, with the exception of the posterior femora, which are fulvous and strongly punctured. Underside fulvous. ♂ with the first segment of the anterior tarsi more dilated.

N.W. RHODESIA: Mwingwa, 2. viii. 1914 (*H. C. Dollman*), 10 specimens.

Allied to *B. regularis* Jac., but smaller, and differs chiefly in the sculpture of the prothorax, *regularis* Jac. being almost smooth and nitid.

Blepharidella knighti, sp. n. (Fig. 5.)

Dark brown, the prothorax with a flavous pattern and with large irregular punctures, the elytra with brown striæ, punctate-striate, the intervals narrowly flavous.

Length 6 mm.

♂. Head brown, rugosely punctured, clothed with short scattered pubescence, the clypeus paler. Antennæ long, extending almost to the middle of the elytra, fulvous, the first segment long and more dilated. Prothorax transverse, dark brown, with a flavous pattern, the side-margins narrowly flavous, the basal margin with a double broken transverse flavous line, the anterior margin with a broken flavous line, a median flavous patch on the anterior half, a longitudinal curved flavous line inside the side-margins, an irregular slanting V-shaped

flavous marking below the frontal median patch, and two short lines near the anterior angles. Scutellum brown, triangular, impunctate. Elytra with dark brown striae, strongly punctate striate, the intervals with narrow flavous lines, slightly carinate. Legs fulvous, clothed with short fine ashy pubescence, claws appendiculate. Underside fulvous, the ventral segments of the abdomen punctured and pubescent, the apical segment notched.

KENYA COLONY: Makuyu, 3. v. 1937 (*C. D. Knight*).

A very distinct species on account of its dark colour, and the elytra with alternate dark and pale striae.

Blepharidella pallida, sp. n. (Fig. 6.)

Pale flavous, the head and legs darker, the elytra strongly punctate striate, the punctures fulvous and not close together.

Length 5-5.5 mm.

Head fulvous, with the clypeus flavous, deeply impressed near the eyes and rugosely punctured near the eyes and the base, the front and a longitudinal narrow patch between the antennae impunctate. Antennae flavous, with the five apical segments slightly darker, extending slightly beyond the base of the prothorax, the first segment long and more dilated, about equal to the second and third together. Prothorax pale, flavous, very transverse, the sides contracted and rounded in front, a deep punctured impression curving from the anterior margin towards the side-margin near the anterior angles, and a short longitudinal impression on each side near the basal margin, the basal margin with a few strong punctures. Scutellum fulvous, triangular, impunctate. Elytra pale flavous, strongly punctate-striate, the punctures fulvous and not very close together, the side-margins with a few fulvous spots. Legs fulvous, clothed with fine short golden pubescence, the posterior femora strongly incrassate and punctured. Underside fulvous, clothed with short fine golden pubescence.

S. AFRICA Cape Province, Mossel Bay, iv. 1921 (*R. E. Turner*), 19 specimens.

Somewhat allied to *B. nigrotransellata* Baly, but differs in the position of the thoracic impressions, and its almost entirely pale flavous colour.

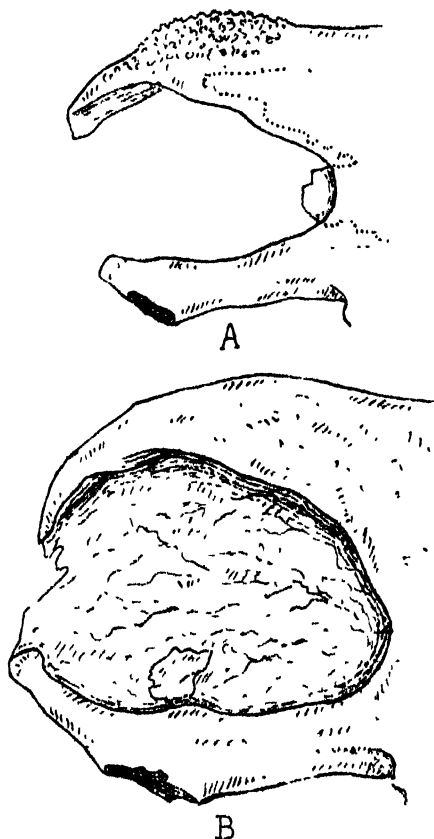
XXXI. - *The Nasal Septum in existing Asiatic Rhinoceroses.*

By R. I. Pocock, F.R.S. (Zoological Dept., British Museum of Natural History).

As is well known the extinct woolly rhinoceros (*Tichorhinus antiquitatis*) takes its generic name from the complete ossification of the median nasal septum up to the anterior ends of the nasals and premaxillæ. In existing rhinoceroses the septum is never ossified throughout and is usually entirely absent in the anterior part of the nasal chambers in dried skulls, being presumably removed by maceration and cleaning. But in one very old ♀ skull of *Rh. sondaicus*, in the British Museum, from Perak (Vernay, 32.10.21.1), it persists as a hard, apparently membranous plate with the same extension as in *Tichorhinus antiquitatis*; and it is strengthened on each side inferiorly by an irregularly-shaped bone attached to it just above the level of the posterior end of the alveolus of the large incisor of the premaxilla. This is the only skull I have seen in which this septum is preserved, and in the posterior part of the nasal chambers it is no doubt continuous with the ossified mesethmoid developed more or less in skulls of all rhinoceroses (fig. 1, B).

In an adult, but not old ♂ skull of *Rh. sondaicus* from the Sanderbans, Fraser (Journ. As. Soc. Beng. xliv. pt. 2, p. 10, pl. v. 1875) described and figured the mesethmoid as forming a complete partition three inches in front of the ethmoid, and as extending above along the lower surface of the nasals as far as the hinder end of the 'horn-boss,' where it was one inch deep, and similarly below along the upper surface of the vomer. But in addition this skull had an isolated bone, described by Fraser as part of a septum narium, attached to the lower surface of the anterior end of the nasals. It was nearly four inches long, overlapped the nasals laterally and extended about two inches below their tips, its apex being about that distance above the anterior ends of the premaxillary processes. A second skull from the Sanderbans mentioned by Fraser was apparently similar; and Peters (Mon. A. K. Wiss. Berlin, 1877, p. 71, pl. i.) figured a third skull of the same species from the Sanderbans, namely the type of *inermis* Lesson, clearly showing the presence of the

Fig. 1.



- A.—Side view of the anterior nares of an old ♂ skull of *Ididermoceros sumatrensis* from Siboga, S.W. Sumatra, showing the nasal septum extending from the lower surface of the nasal bones above to the vomer below, nearly reaching the margin of the nares in its upper portion and projecting a little beyond it in its lower portion (its concealed edge represented by dotted lines.)
- B.—The same of a very old ♀ skull of *Rhinoceros sondaicus* from Perak in the Malay Peninsula, showing the unossified septum extending to the anterior ends of the nasals and premaxillae, which are exceptionally elongated, with its inferior ossification at the level of the alveolus of the tusk of the premaxilla. (The premaxillae of this skull, with their unusually lengthened and fused anterior processes, were recently figured and described in *Ann. & Mag. Nat. Hist.* (11) xi, pp. 834-842, 1944.)

same bone beneath the tip of the nasals. There is no trace of it, however, in a skull from that locality in the British Museum (76.3.30.1), nor in one figured by Blyth in 1862 (Journ. As. Soc. Beng. xxxi. pl. i. fig. 2); but perhaps it was lost in the process of cleaning. And it is absent in all the other available skulls of this species.

In the skulls of *Rh. unicornis* the anterior part of the nasal chambers shows no evidence of a septum or of the special ossifications connected with it, described above in the skulls of *Rh. sondaicus* from Perak and the Sanderbans. But in an old ♂ skull figured by Blainville and in another in the British Museum (No. 51.11.10.2), there is a low, erect upgrowth from the premaxilla on each side, occupying nearly the same position as the septal bone in the skull from Perak, which is only attached to the premaxilla by connective tissue.

In *Didermoceros sumatrensis* the nasal septum seems to be better developed than in the Asiatic one-horned rhinoceros. In an old ♂ skull from Siboga, S.W. Sumatra (Schreber, 94.9.24.1), it is represented by a double lamina of delicate bone with its free anterior edge clearly broken, but it extends above beneath the middle line of the nasals as far as the centre of the greatly roughened "horn-boss" and below is visible in profile view, projecting slightly beyond the posterior margin of the nasal aperture above the base of the maxillary process supporting the premaxilla. How much further forwards it may have extended before being fractured it is impossible to say. Posteriorly it is continuous with the thickly ossified mesethmoid (fig. 1, A).

In a still older ♀ skull, the type of *lasiotis* (1.1.22.1) from Chittagong, the thickly ossified mesethmoid reaches farther forwards, almost up to the posterior edge of the nasal aperture, without being quite visible in profile view, but above it is continued as a ridge along the lower surface of the nasals beneath the "horn-boss," and here it is visible when the skull is viewed from the side. In my opinion, there is no doubt that the delicate laminate extension of the mesethmoid present in the Sumatran skull was also developed in the skull from Chittagong, and probably reached about half-way along the nasal apertures; but no trace of it now remains.

In these, and some other adult skulls of the species, there is a pair of low, nearly parallel ridges extending along the lower side of the nasals, forming a shallow groove along which presumably the upper edge of the septum extended: but in the old ♀ skull of the type of *niger* (No. 72.12.31.1), from Malacca, there is on the lower side of the nasals just behind the level of the "horn-boss," but not quite visible in profile view, a bilaminate bony down-growth which apparently embraced and supported the missing delicate anterior extension of the septum. In a young skull from British North Borneo there are no ridges on the lower surface of the nasals and the bony septum is practically negligible, being developed only far back in the nasal chambers.

XXXII.—*Note on some South African Terrestrial Isopoda.*

By WALTER E. COLLINGE, D.Sc., President of the Northern Ecological Association.

COMPARATIVELY speaking only little attention has been paid to the Terrestrial Isopoda of South Africa, and most of the papers dealing with such have been written by non-residents. The geographical situation has more than usual interest.

For some time past I have been receiving collections made in Zululand, Natal, Rhodesia and elsewhere, which have added considerably to our knowledge of the distribution. Some of the material still awaits investigation.

During the past few years numerous new genera and subgenera have been proposed, many on the most trivial characters and quite inadequate diagnoses. It is exceedingly regrettable that this confusion should be introduced into an already difficult subject, a closer and wider acquaintance with the salient features of generic distinction would have obviated this distressful practice. Moreover, many of the new genera and subgenera are diagnosed in two, three or five lines of print!

In my papers on the Terrestrial Isopoda of Natal*, owing to the carelessness of the artist, the correct number of mesosomatic and metasomatic segments, in a number

* Ann. Nat. Mus. 1917, iii. pp. 567-585, pls. xl.-xln.; 1919, vi. pp. 229-233, pl. xiv.; 1920, iv. pp. 471-480, pls. xxvii.-xxxii.

of cases, are wrongly shown. It is at once evident that these are not cases of teratology or abnormalities, as presumed by Mr. Barnard*, they are errors; all the specimens were normal.

Curiously, Mr. Barnard in *his own figures* has fallen into the same error: thus on p. 189 he figures *Ligia dilutata* with seven metasomatic segments; on p. 203, *Parantoniscus montanus* is shown with only five segments in the metasome; on p. 207, *Phylloniscus braunsi* is given eight mesosomatic segments, and on p. 319, *Akermania* is depicted with only four metasomatic segments! One or two others are doubtful, the thumb-nail sketches not always being clear.

"Humanum est errare," but those who live in glass-houses should not throw stones.

I am now able to add the following new localities to thirteen species and a new species to be described later: -

Tylos granulatus Krauss.

Die Sudafr. Crust. 1843, p. 64, pl. 4, fig. 3

Hab. Natal, Durban Bay.

Deto echinata Guérin.

Mag. Zool. 1836, vi. p. 2, pl. xiv

Hab. Natal, Durban Bay.

Alloniscus spatulifrons (Barn.).

Ann. S. Afr. Mus. 1932, xxx. p. 234

A single specimen from near Cape Town is probably an immature example of this species, but the uropoda are entirely different from those figured.

Philoscia dilectum Cllge.

Ann. Nat. Mus. 1917, iii. p. 597, pl. xlii. figs. 21-31.

Hab. Natal, Durban Bay. Rhodesia, Sanyati Valley.

My collector writes: "This species occurs in thousands all along the littoral, frequently to the exclusion of all other species."

* Ann. S. Afr. Mus. 1932, xxx. pp. 179-388, 80 figs.

Philoscia warreni Cllge.

Ann. Nat. Mus. 1917, iii. p. 575, pl. xlii.

Hab. Natal, Inchanga; Winkle Spruit.

Rhyscotus bicolor Barn.

Ann. S. Afr. Mus. 1924, x. p. 235.

Hab. Natal, Winkle Spruit.

In the specimens examined I find great differences in the oral appendages from the original description, not that I attach much importance to these parts, which, in my opinion, have only a secondary value, varying as they do according to age, sex and environment.

Possibly only a variety of *R. globiceps* B.-L.

Anchicubaris scoriformis, sp. n.

This differs from *A. fongonensis* Cllge.* and *A. spinosus* Cllge.† in the body being more ovate, convex, and the whole surface scoriaceous.

Colour (in alcohol) light chocolate-brown.

Length 9 mm.

Hab. Near Uhamos, Zululand.

To be described in detail later.

Anchicubaris spinosus Cllge.

Ann. & Mag. Nat. Hist. 1942 (11), ix. p. 718.

Hab. Rhodesia, Bulawayo.

Genus CUBARIS Brandt.

Van Name ‡ has grouped the members of this genus under five sections, but has very wisely refrained from giving them generic names.

Our knowledge of the genus and its allies is as yet very imperfect, and in my opinion no useful purpose can be attained by the setting up of new genera and subgenera on trifling differences.

Cubaris truncatus Cllge.

Ann. Nat. Mus. 1920, iv. p. 480, pl. xxx. figs. 48-56.

Hab. Cape Province, Grahamstown.

* Ann. Nat. Mus. 1920, iv. p. 484, pl. xxxii. figs. 86-96.

† Ann. & Mag. Nat. Hist. 1942, p. 718.

‡ Bull. Amer. Mus. Nat. Hist. 1936, lxxi. pp. 328-331.

Cubaris griseus Cllge.

Ann. Nat. Mus. 1920, iv. p. 483, pl. xxxi. figs. 77-85.

Hab. Natal, near Durban.

Cubaris burnupi Cllge.

Ann. Nat. Mus. 1917, iii. p. 572, pl.xh. figs. 1-10.

Hab. Natal, Inchanga.

Cubaris natalensis Cllge.

Ann. Nat. Mus. 1917, iii. p. 573, pl. xli. figs. 11-20.

Hab. Natal, Port Edward; Durban.

Cubaris barbertoni Barn.

Bethulus barbertoni Barnard, Ann. S. Afr. Mus. 1932, xxx. pp. 312, 313 fig. 45.

A very doubtful species, but specimens from Modderfontein are possibly referable to this form.

Pseudarmadillo rugosa Cllge.

Ann. & Mag. Nat. Hist. 1942 (11), ix. p. 719.

Hab. Rhodesia, Salisbury.

XXXIII.—*Cetacea stranded on the British Coast during 1944.*

By F. C. FRASER, Department of Zoology, British Museum (Natural History).

UNDER the scheme for reporting to the British Museum (Natural History) the stranding of "Fishes Royal," twenty-three records were received during 1944. The Receivers of Wreck and their officers are to be commended for the attention they have paid to this work when their normal duties must be making the greatest demands upon their time.

The data relating to the specimens are set out in the table.

With the exception of stranding no. 19, one animal only was involved in each instance.

Strandings in order of frequency of occurrence are as follows :—

Common Porpoise, <i>Phocaena phocaena</i>	6
Finner Whale, <i>Balaenoptera physalus</i>	2
Killer Whale, <i>Orcinus orca</i>	2

Pilot Whale, <i>Globicephala melana</i>	2
Bottle-nosed Dolphin, <i>Tursiops truncatus</i>	2
Common Dolphin, <i>Delphinus delphis</i>	2
Lesser Rorqual, <i>Balaenoptera acutorostrata</i>	1
Cuvier's Whale, <i>Ziphius cavirostris</i>	1
Bottle-nosed Whale, <i>Hyperoodon rostratus</i>	1
Risso's Dolphin, <i>Grampus griseus</i>	1
White-beaked Dolphin, <i>Lagenorhynchus albirostris</i> ...	1
Unidentified	2

Notes on some of the Specimens.

Ziphiidæ.

S.W. 1944/4. *Ziphius cavirostris*, ♂. Photographs of the skull of this animal were received from Dr. Stelfox, National Museum of Ireland. The form of the meso-rostral ossification with excavated posterior end and the size and shape of the teeth were characteristic of the male of the species concerned.

S.W. 1944/12. *Hyperoodon rostratus*. The length of this animal was stated to be 26 feet, and that it was a fully-grown specimen is indicated by the jaws, with firmly fused symphysis, and by the teeth. One of the latter, sent to the Museum with the lower jaws, is 45 mm. long, and has a greatest diameter of 18 mm., with the diameter at right-angles to this 15 mm. The tip of the tooth is slightly damaged, but shows no signs of normal wear. The pulp cavity is completely closed. It is probable that the animal was a female.

Delphinidæ.

S.W. 1944/2 and 23. *Orcinus orca*, ♂. Both specimens were male with typical colour-markings. The dorsal fin of S.W. 1944/2 was stated to be 5 feet in height, and the sketch of S.W. 1944/23 indicated that it too had the high triangular dorsal fin which develops in males as they get older.

S.W. 1944/10. *Grampus griseus*, ♂. Most of the strandings of Risso's Dolphin are on the south and west coasts, on the east coast they are comparatively rare. The lower jaw of S.W. 1944/10 were sent to the Museum. There are six teeth on the left side and five on the right. The pulp cavities of the teeth are almost obliterated. This and the firmly fused mandibular symphyses indicate that the animal was adult.

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No.	Date. 1944.	Locality.	County.	Length.	Species.
1	Feb. 5	North Sunderland Point	Northumberland	9' 0"	<i>Balenoptera acutirostrata</i>
2	" 15	Unst.	Shetland	26' 0"	<i>Orcinus orca</i> , ♂.
3	" 17	St. Agnes.	Cornwall	66' 0"	<i>Balenoptera physalus</i> , ♂.
4	" (1943)	Slyne Head	Galway	ca. 15'	<i>Ziphius cavirostris</i> , ♂.
5	Mar. 30	South Uist	Outer Hebrides	—	Unidentified.
6	April 18	Menie Sands	Aberdeen	4' 0 1/2"	<i>Phocaena phocaena</i> , ♀.
7	April 24	Cable Bay	Anglesey	20' 0"	Unidentified.
8	"	Fleetwood	Lancashire	—	<i>Phocaena phocaena</i> .
9	May 19	Hornaby	Norfolk	ca. 5' 6"	<i>Delphinus delphis</i> .
10	" 21	Nigg Bay	Aberdeen	10' 6"	<i>Grampus griseus</i> , ♂.
11	" 28	Carnoustie	Angus	18' 2"	<i>Globicephala melana</i> , ♂.
12	" 29	Loch Ryan	Wigtown	26' 0"	<i>Hyperoodon rostratus</i> .
13	June 22	St. Andrew's	Fife	9' 0"	<i>Lagenorhynchus albirostris</i> .
14	July 15	Ehenss	Fife	4' 8"	<i>Phocaena phocaena</i> , ♀.
15	Aug. 15	Brooksea Point	Glamorgan	6' 3"	<i>Tursiops truncatus</i> .
16	" 12	Menie	Aberdeen	3' 0"	<i>Phocaena phocaena</i> , ♂.
17	" 23	Aberffraw	Anglesey	3' 6"	<i>Phocaena phocaena</i> .
18	" 15	Aberdeen	Aberdeen	9' 10"	<i>Tursiops truncatus</i> .
19	" 31	Conway Estuary	Caernarvon	20' 1"	<i>Globicephala melana</i> , ♂.
				18' 9"	<i>Globicephala melana</i> , ♂.
				16' 7"	<i>Globicephala melana</i> , ♂.
				15' 9"	<i>Globicephala melana</i> , ♂.
				10' 3"	<i>Globicephala melana</i> , ♂.
				9' 7"	<i>Globicephala melana</i> , ♂.
				9' 5"	<i>Globicephala melana</i> , ♂.
				8' 5"	<i>Globicephala melana</i> , ♂.
				8' 1"	<i>Globicephala melana</i> , ♂.
				15' 1"	<i>Globicephala melana</i> , ♂.
				15' 0"	<i>Globicephala melana</i> , ♂.
				12' 6"	<i>Globicephala melana</i> , ♂.
				11' 9"	<i>Globicephala melana</i> , ♂.
				10' 8"	<i>Globicephala melana</i> , ♂.
				10' 6"	<i>Globicephala melana</i> , ♂.
				9' 6"	<i>Globicephala melana</i> , ♂.
20	Oct. 4	Morte Bay	Devon	7' 0"	<i>Delphinus delphis</i> .
21	Nov. 23	Trachinawr	Pembrokeshire	4' 11"	<i>Phocaena phocaena</i> , ♂.
22	Dec. 17	Skunninggrove	Yorkshire	65' 0"	<i>Balenoptera physalus</i> , ♂.
23	" 25	Druridge Bay	Northumberland	21' 7"	<i>Orcinus orca</i> , ♂.

1944/19. *Globicephala melæna*. Prof. F. W. Coope. Brambell, Bangor, examined the Pilot Whales which stranded in the Conway Estuary, and I am indebted to him for the records of length and sex detailed in the table. Strandings of this species on the British coast are usually of single specimens, although large schools frequent the Orkney and Shetland Islands, where they are hunted and driven ashore. The only record comparable to S.W. 1944/19 for the rest of the country happened in 1911, when a school of 50 stranded at Penzance.

1944/13. *Lagenorhynchus albirostris*. The one record of a White-beaked Dolphin is from a stretch of the coast where the stranding of this species is prevalent. The identification was confirmed by some of the teeth which were sent to the Museum.

XXXIV.—*Descriptions and Records of Bees*.—CXC VII.

By T. D. A. COCKERELL, University of Colorado.

Halictus xerophilinus, sp. n.

♀.—Length about 5 mm., anterior wing about 3.7 mm.; black, with white pubescence; head approximately circular seen from in front; face and front hoary with thin white hair, but not forming dense patches at sides of face; mandibles somewhat reddish; apical part of flagellum red beneath; clypeus not produced, it and the supraclypeal area moderately shining; shining line along orbits only at upper end; mesonotum polished, with a distinct median groove; scutellum polished; postscutellum with dull white tomentum; area of metathorax shining, with distinct plicæ, under the microscope it appears pitted; tegulæ small, light reddish; wings clear hyaline, the stigma pale red with a heavy dark margin; basal nervure meeting nervulus; second submarginal cell broad, receiving recurrent nervure shortly before end; outer nervures moderately weakened; marginal cell rather obtuse at end; legs black; hind spur with a large oblique lamella; abdomen broad, shining, the first tergite very highly polished, and with hair-spots at extreme sides; the other tergites with basal bands of white hair, on second reduced to two large cuneiform marks, the band failing in middle, on third and fourth broad and entire.

Uganda: 1918 (*J. R. Yardley*). It comes with a "Sudan Govt." label and number C, 4913. It has the aspect of a

desert bee, and presumably comes from northern Uganda, near to the Sudan. The shining thorax, the abdomen and the dark-margined stigma suggest alliance with *H. giffardiellus* Ckll., from the Sudan, but I do not believe it is the female of that species, which was described from the male. *H. pernitens* Ckll. has some points of resemblance, but differs by the dark stigma, the banding of abdomen, and other characters.

Since writing the above, I have found in the collection from the Sudan the following females of *H. xerophilinus* :—

Ceteina, three collected by H. B. Johnston, April and June, 1928, from melon flowers and in grass native hut.

Khartoum, two collected by R. Cottam, April 24, 1915.

Wad Medani, one collected by H. B. Johnston, March, 1928, swept from flowers.

I also find males of *H. giffardiellus* Ckll., as follows :—

Shendi, Nov. 20, 1926, on cotton (*W. E. Giffurd*).

Khartoum, Jan. 10, 1929, on lubia (*H. W. Bedford*).

Mogren, June 16, 1930, on berseem (*H. W. Bedford*).

Halictus kingi, sp. n.

♂.—Length about 7 mm., anterior wing 5; black, robust, with white pubescence, rather thin on front and sides of face, short on mesonotum, but giving it a hoary appearance, dense tomentum on postscutellum; head rather broad; mandibles obscurely reddish; clypeus with a median round subapical pit; supraclypeal area shining; (antennæ missing in type); mesonotum polished on disc, gullish in front, with a very distinct median groove; scutellum shining, with a strong median groove; area of metathorax short, moderately shining, not plicate, with an apical pit; tegulae black; wings clear hyaline, iridescent, stigma pale reddish, with no dark margin; nervures very pale, outer nervures weakened; second submarginal cell very broad; first recurrent nervure joining basal corner of third submarginal cell; legs black, with pure white hair, tarsi reddish at end; hind spur with a few rather short stout teeth, the apical part curved and without teeth; abdomen broad, polished: first tergite with a large patch of hair on each side; second with a narrow basal band, entire except for a linear interruption in middle; third with a band which is broad at sides, but fails in the middle, and also with a narrow subapical band; fourth with an apical band.

Sudan: Erkowit, May 17, 1917 (*D. King*, C. 4942). *H. shendicus* Ckll, from Shendi, Sudan, has a shorter, broader head, and narrow dark-margined stigma; the area of metathorax also is different. There is some resemblance to *H. leucophenax* Ckll., to which it runs in the key in *Ann. & Mag. Nat. Hist.*, June, 1939, p. 600. *H. zonaturus* Ckll., from Entebbe, has the wings rather dusky, area of metathorax larger, with no apical dimple.

Halictus (Seladonia) sudanicus, sp. n.

♀.—(Type). Length about 6 mm., at first confused with *H. dissensis*, but distinct by the following characters: dark blue-green, the abdomen very broad, the apical bands of tergites (failing in middle on first) very distinct, but no basal bands, except at sides of second tergite; head longer; area of metathorax shorter, crescentic, densely rugose punctate, with a narrow apical very minutely sculptured zone. In *H. dissensis* the tergites beyond the second appear pruinose-pubescent, which is not the case with *H. sudanicus*. The mesonotum of *H. sudanicus* is densely punctured.

♂.—A male presumed to belong here is smaller and narrower, face densely covered with white hair; clypeus with a broad yellow apical band; antennae reaching about to scutellum, last two joints black; tibiae and tarsi light yellow, but the middle and hind tibiae with a large black mark.

Sudan, ♀ (Type): Shendi, Nov. 15, 1928, on berseem (*A. H. Husein*, C. 4952); ♂, Diassa, Feb. 24, 1929, on shatta plant (*R. S. Audas Bey*, C. 10999).

Also four other females, from Shampat, Jan. 2, 1923, in house (*H. W. Bedford*); Diassa, Feb. 24, 1929 (*R. S. Audas Bey*); Wad Medani, March 3, 1928, swept from flowers (*H. B. Johnston*); Mogram, June 23, 1930, on *Hibiscus* (*H. W. Bedford*).

Evidently related to *H. tumulorum* L., a common European species which has not been found in North Africa.

Halictus (Seladonia) tokarensis, sp. n.

♀.—Similar in most respects to the species just described, but distinguished by the mesonotum, which although densely punctured is highly polished, the punctures are more or less in rows; the area of metathorax has a short

reticulate basal area, beyond which it is shining, conspicuously punctured at sides; it is broadly truncate, the posterior margin thickened and concave; the head is dull, but the clypeus shining; abdomen very broad; brassy green, the bands dull white and very distinct; second submarginal cell broad below; middle and hind tibiae infuscated.

Sudan: Tokar, on flowers of castor oil plant, June 3, 1916 (*R. Cottam*). Three specimens. I was in doubt whether to separate this from *H. sudanicus*, but the polished mesonotum and structure of the metathorax appear to be sufficiently distinctive. By the shining mesonotum it resembles *H. subauratus* Lep. (*smaragdulus* Vachal).

Halictus (Seladonia) dissensis, sp. n.

♀.-Length about 6 mm., anterior wing 4.3 mm.; head, thorax and abdomen bluish green; legs basally black, but with knees, tibiae and tarsi light reddish, the hind tibiae with a blackish stain on inner side; head broad; mandibles dark; flagellum red beneath; sides of face with dull white hair; clypeus and supraclypeal area shining, margin of clypeus black; mesonotum and scutellum shining, with little hair, postscutellum covered with pale hair; area of metathorax dull, rather small, the microscope shows fine dense pitting and plication, the apical part minutely roughened; sides of metathorax brilliantly polished; tegulae pale yellowish; wings clear, with very pale stigma and nervures; second submarginal cell small, receiving recurrent nervure a considerable distance from end; third submarginal apically produced, so as to be more than twice as broad as second; hind spur with large obtuse spines; abdomen shining, the first tergite with large hair-patches at sides, but no well defined apical band; second with a very broad basal band, and a narrow apical one; third and fourth similarly clothed, but apical band on third broader, and basal band on fourth thin and indistinct; apex pale. The hair-bands are slightly ochraceous.

Sudan: Disa, F. P., on shatta plant, Feb. 24, 1929 (*R. S. Aulas Bey*, C. 10998). On account of the colour of the legs, this falls with *H. ochropus* Blüthgen, from Algeria, but that is larger (7.5 mm) and has the abdominal bands reddish yellow. Compared with *H. pollinosus* Stöbel, from Morocco, *H. dissensis* is much smaller, with ochreous-tinted instead of pure white pubescence.

Halictus (Seladonia) audasi, sp. n.

♀.—Similar to *H. dissensis*, but area of metathorax very large, dark blue, rounded behind, minutely sculptured all over, the microscope shows very delicate transverse wrinkles; the mesonotum is quite different, approximately the anterior half being covered with pale appressed tomentum, and the lateral and posterior margins have pale tomentum, so that there is a very conspicuous broad light band before the scutellum; the disc of mesonotum, which is exposed, is seen to be densely and minutely punctured; the light hair-bands at bases of second and third tergites are very broad, but the apical bands are feebly developed.

Sudan: Sawleil, F. P., by sweeping cotton, March 6, 1929 (*R. S. Audus Bey*, C. 11028). A very distinct species, at once recognised by the large, dull, dark blue area of metathorax. The abdomen is only feebly metallic, but the first tergite is shining steel-blue basally. The mesonotum is dark green.

Halictus (Seladonia) medanicus, sp. n.

♂.—Length about 6 mm., anterior wing 4.2 mm.; robust, the thick abdomen parallel-sided; head and thorax dark green, abdomen black; mandibles red, black at apex; head moderately broad, vertex not elevated; eyes black (shining greenish in *H. mogrensis*), clypeus and supra-clypeal area polished; flagellum obscurely reddish beneath; mesonotum shining but hardly polished, very densely punctured; scutellum shining, grooved in middle; postscutellum inconspicuously hairy; area of metathorax rather large, broadly truncate behind, basally densely lineolate and punctate, apical part not distinctly sculptured; tegulae pale testaceous; wings clear hyaline, stigma and nervures extremely pale; second submarginal cell broad, receiving recurrent nervure at apical corner; tarsi and front tibiae pale red; knees pale; middle and hind tibiae dusky, with much pale hair; abdomen black, the third tergite perhaps very faintly greenish; first tergite without well defined lateral hair-spots; second to fourth tergites with apical bands of white (not at all yellowish) hair; second and third with entire basal bands; fourth thinly pubescent.

Sudan: C. R. F. Medani, Feb. 1, 1923, in house (*H. W. Bedford*, C. 4883). A distinct species, suggestive of *H. vestitus* Lep. (which I have from Mogadar), but with the abdomen not so tomentose.

Halictus (Seladonia) mogrensis, sp. n.

♀.—Length about 6 mm. ; head and thorax green, the head broad, about as in *H. pseudolittoralis* Blüthg. ; mandibles dark ; flagellum red beneath ; supraclypeal area shining green, but clypeus black, strongly punctured, the upper margin greenish ; sides of face and front with thin white hair ; mesonotum exposed, shining but not polished, densely punctured ; scutellum shining, rather brassy green ; postscutellum not conspicuously hairy ; area of metathorax triangular, dull, with a thick shining margin, the dull part is minutely sculptured, the apical portion very finely (microscopically) lineolate all over ; tegulae pale testaceous ; wings clear hyaline, the stigma and nervures very pale ; second submarginal cell rather broad, receiving recurrent nervure some distance from end ; legs with the knees, tibiae and tarsi red ; hind spur with blunt spines ; abdomen rather obscurely greenish, first tergite red apically ; no distinct hair-spots at sides of first tergite ; second and following tergites thinly white and hairy the second with a broad basal band ; apical bands weak.

Sudan : Mogren, June 23, 1930, on tomato plants (*H. W. Bedford*, C. 10978). Related to the species described above, but distinguished by the red margin of first tergite, and other characters as described. In the keys it runs near to *H. tumulorum* L.

Halictus (Seladonia) tokariellus, sp. n.

♂.—Length about 4.7 mm. ; head obscurely green, more distinctly so on vertex ; mesonotum and scutellum shining brassy green ; abdomen black ; head rather broad, but the face considerably narrower than in *H. pici* Pérez ; extreme margin of clypeus pallid, but no distinct band ; face and lower part of sides of front with much pure white hair ; antennae reaching about to scutellum, flagellum dull red beneath, not black at end ; mesonotum polished, exposed, with punctures not so dense as in *H. sudanicus*, running largely in lines ; scutellum shining, not distinctly grooved in middle ; area of metathorax short, finely lineolate, much as in *H. sudanicus* ; legs with pale yellow tarsi ; the tibiae mainly black, but light at ends ; abdomen shining, with white hair-bands on apices of tergites, second and third also with basal bands.

Sudan : Tokar, at Abutilon, Jan. 6, 1932 (*A. H. Hussein*, C. 11024). The sculpture would suggest that this is the male of *H. tokarensis*, but the black abdomen is distinctive,

Halictus (Seladonia) medaniellus, sp. n.

♂.—Length about 6 mm. ; head and thorax dark green ; abdomen with first three tergites brown, with green tints, beyond the third tergite the abdomen is dark green ; head rather broad, approximately circular seen from in front ; clypeus with an apical very pale yellow band ; face and lower half of front densely covered with white hair ; antennæ long, not black at end, flagellum red beneath ; mesonotum dullish, densely punctured as in *H. sudanicus* ; area of metathorax also as in *H. sudanicus* ; scutellum brassy green, polished, without a median groove ; tegulæ pale ; wings rather short, clear hyaline, stigma pale yellowish ; nervures pale, except outer half of marginal cell ; second submarginal cell rather broad, receiving recurrent nervure some distance from end ; legs with the tibiæ and tarsi light yellow, the tibiæ with a pale reddish mark ; front femora light yellow above, middle femora brownish, hind femora black with pale knees ; second and third tergites with pale basal hair-bands, apical hair-bands very weak, hardly noticeable. '

Sudan : C. R. F. Medani, March 17, 1925, by sweeping cotton (*H. W. Bedford*, C. 11026). This species is suggestive of *H. pici* Pérez, which I have from Bengasi, Cyrenaica (*Geo. C. Krüger*), but this is readily separated by the dense pubescence.

The species of *Seladonia* from the Sudan, described above, may be separated as follows :--

Males	1.
Females	3.
1. Abdomen black	<i>tokariellus</i> .
Abdomen green	2.
2. Tergites 1 to 3 brown, with green tints	<i>medaniellus</i> .
Tergites not brown ; antennæ black at end	<i>sudanicus</i> .
3. Area of metathorax very large, dark blue	<i>audasi</i> .
Area not so	4.
4. First tergite rufous apically	<i>mogrensis</i> .
First tergite not so margined	5.
5. Mesonotum highly polished	<i>tokarensis</i> .
Mesonotum duller	6.
6. Abdomen broad, with very distinct hair-bands, tergites not pruinose	<i>sudanicus</i> .
Abdomen not so broad, more pruinose	7.
7. Hair of abdomen greyish white	<i>medanicus</i> .
Hair of abdomen subochreous	<i>dissensata</i> .

H. littoralis Blüthg. will be distinguished from the above by the dark legs, and the same is true of *H. virens* Erichs. (*simulans* Pérez) and *H. aureolus* Pérez.

Halictus triangulinus, n. n.

New name for *H. trianguliferus* Ochl., from Zanzibar, the name preoccupied.



1



2



4



6



3



5

F., photo.

Some New Fossils from the Balclatchie Beds, Girvan

THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

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XXXV.—*Notes on the Jurassic Flora of Yorkshire, 19–21.*
By TOM M. HARRIS, University of Reading.

19. *Klukia exilis* (Phillips) Raciborski. (Figs. 1–3.)

1829. *Pecopteris exilis* Phillips, p. 148, pl. viii. fig. 16. (Poor figure of fertile fragment.)
1837. *Pecopteris obtusifolia* Lindley and Hutton, pl. clviii. figs. 1, 1 a, 1 b (? non clvii. fig. 1 c). (Fertile leaf.)
1851. *Pecopteris exilis* Phillips, Bunbury, p. 188, pl. xiii. fig. 5. (Fertile fragment, sporangia.)
1891. *Klukia exilis* (Phillips) Raciborski, p. 1. (Name only; pl. i. fig. 16–19 represents another species.)
1894. *Klukia acutifolia* (non L. & H.) Raciborski, p. 168, pl. vii. figs. 10–12, 18. (Sterile and fertile fragments.)
1894. *Klukia exilis* (Phillips) Seward, p. 197, figs. 1–5. (Fertile fragments, sporangia.)
1900. *Klukia exilis* (Phillips) Seward, p. 130, pl. xvi. fig. 7. (Fertile fragment.)
1907. *Klukia exilis* (Phillips) Seward, p. 4, pl. i. figs. 4–7, pl. iii. fig. A. (Fertile fragment.)
1912. *Klukia exilis* (Phillips) Seward, p. 11, pl. ii. figs. 20, 21; pl. vi. fig. 81; pl. vii. fig. 88. (Fertile fragments, sporangia.)
1933. *Klukia marginata* Prinada, p. 6, pl. i. figs. 1–6. (Good sterile and fertile leaf-fragments.)

The following figures represent species of *Klukia* distinct from *K. exilis* Phillips:—

- Raciborski (1891), pl. i. figs. 16–19. Raciborski (1894), p. 22, pl. vii. figs. 13, 14, 16–17; pl. viii. figs. 1–9; pl. ix. figs. 1–2; pl. xxvi. figs. 1–2. (Fine sterile and fertile leaves named *K. exilis*, *K. exilis parvifolia*, *K. phillipsi*.)
Oishi (1939), p. 305, text-fig. 1. (Fertile fragment as *K. yokohamæ*.) Also Oishi, 1940, p. 199.
Oishi (1940), p. 270, pl. xvii. figs. 3, 3 a; pl. xix. fig. 3. (Fertile fragment as *Cladophlebis* (*Klukia*) *koraiensis*.)

The following sterile specimens are barely determinable or else definitely distinct from *K. exilis* :—

1913. *Cladophlebis* (*Klukia*) *exilis* Halle, p. 17, pl. i. fig. 25. (Mesozoic of Graham Land.) (Indefinite agreement.)
 1916. *Klukia exilis* Kryzhtofovich, p. 97, pl. vii. figs. 4, 5, 6, 8. (Indefinite agreement.)
 1919. Cf. *Pecopteris exilis* Antova, p. 18, pl. i. fig. 16 (different); fig. 17 (indeterminable). (Lower Liass of Sweden.)
 1922. Cf. *Pecopteris exilis* Johanson, p. 13, pl. v. figs. 10, 11. (Indefinite agreement.) (Rhætic of Sweden.)

The following records have been given without figure :—

- Zeiller, 1900, p. 2. (Madagascar.)
 Kraasser, 1908, p. 441. (Austrian Alps.)
 Thomas, 1911, pp. 12, 60. (Kamenka, Russia.)

Introduction.—The existing figures of Yorkshire *Klukia exilis* represent rather poor specimens and give generic rather than specific characters; very fine specimens, however, occur in several museums, and one is figured here. In the absence of definite information about the material from the type (Yorkshire) locality, Raciborski's beautiful figures have been accepted by previous authors as the working basis of *K. exilis*, but most of his specimens probably belong to another species and they need re-examination. Several new specific characters of *K. exilis* are given; in particular details of the spore-coat.

Fragments of *K. exilis* are frequent in the Gristhorpe Bed (Middle Estuarine) and isolated spores occur in the Middle Estuarine Coals of the Cleveland Hills. The present material consists of small fragments in the Department of Geology, British Museum; larger fragments in the Reed Collection, Yorkshire Museum, and some very fine ones in the Leckenby Collection, Sedgwick Museum, Cambridge.

Emended diagnosis.—Leaf large, sterile and fertile leaves similar or partly sterile, partly fertile. Leaf twice pinnate with deeply pinnatifid segments (almost three times pinnate). Rachises of all orders relatively slender, channelled above, rounded below. Pinnules usually 2.5–4 mm. long, united by a web of lamina 0.5 mm. wide. Surface of pinnules convex above, showing an obscure furrow along the midrib; substance of lamina thick, lateral veins obscure, once forked or simple. Margin of pinnules everywhere reflexed, apparent margin either entire or showing very slight marginal lobes; apex

obtuse. Upper surface of lamina almost hairless and smooth; under surface completely covered with short hairs. Sporangia often six, rarely more than fourteen on one pinnule, 0.6 mm. long, 0.4 mm. wide (but often partly concealed in hairs), containing 150–400 spores. Spores roundish to roundish-triangular, thickly cutinised, typically 60μ wide (extremes 40μ and 73μ). Dorsal surface hemispherical, ventral with strong triradiate marks and flat facets. Dorsal surface with deep pits, walls between pits raised irregularly in slight rounded lumps, but not forming definite ridges. Facets bearing numerous small warts, separate or united in groups.

General description.—*Klukia exilis* evidently has a large leaf, but although the specimens I have seen give a fair idea of the upper and middle parts of the leaf where the primary pinnæ may be 15 cm. long, none show the basal pinnæ, and there is no information from which the length of the lamina can be estimated.

More than half of the numerous specimens examined are fertile, but some (fig. 1) are only partly fertile. Although the upper surface is more often exposed than the lower, the presence of the sporangia is shown by distinct bulges, and they were confirmed for several by maceration and preparation of spores, or by transferring to expose the underside. The transfer preparations were not altogether satisfactory because the substance swells and tends to come off the balsam, but a sufficient number of intact pinnules were seen to show that the margin is characteristically reflexed and the underside hairy, giving it a rough brownish surface, while the upper side is black and smooth. The lamina is too thick to allow light to penetrate, and the reflexed margin is as thick as the rest. Although the hairs on the underside are too much matted together to be seen satisfactorily, the appearance suggests that they are simple. On the upper side there are a very few hairs, which are simple pointed structures about 200μ long, 30μ wide near the base. So far as can be seen they may be unicellular.

Certain fertile specimens were immature and yielded unripe spores which could only be separated with difficulty, but others have ripe spores which are very easily prepared. Others, again, have open sporangia, but it always proved possible to find a few spores in them or among the hairs

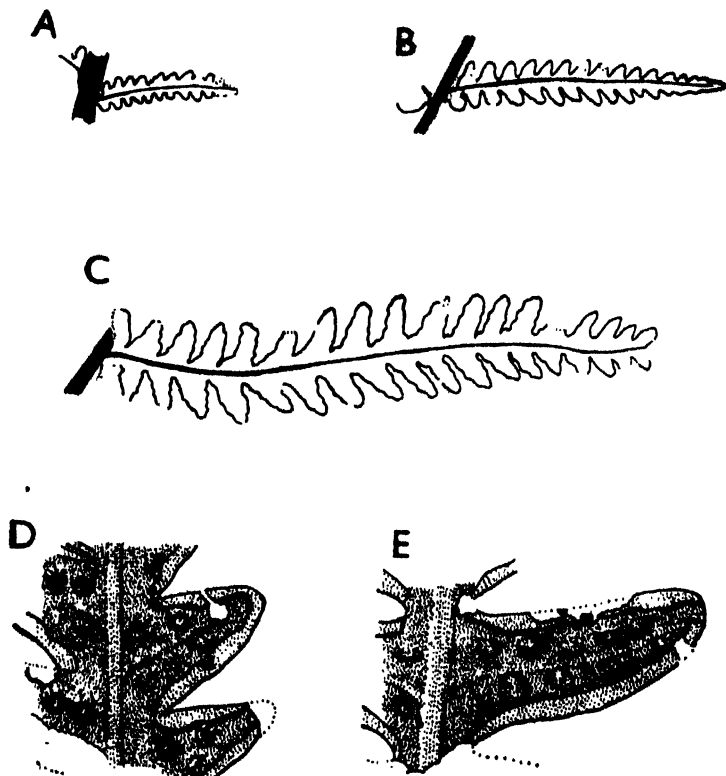
Fig. 1.

*Klukia exilis.*

Leokenby Collection 91, $\times 1$. (About 1 cm. at the sides omitted.)
The lower pinnae are fertile, the upper sterile.)

on the leaf. The sporangia are normally retained after dehiscence. In certain specimens the sporangia appear to differ a good deal in size, but this may be largely due to some being buried in hair. The fourteen sporangia of

Fig. 2.

*Klukia exilis.*

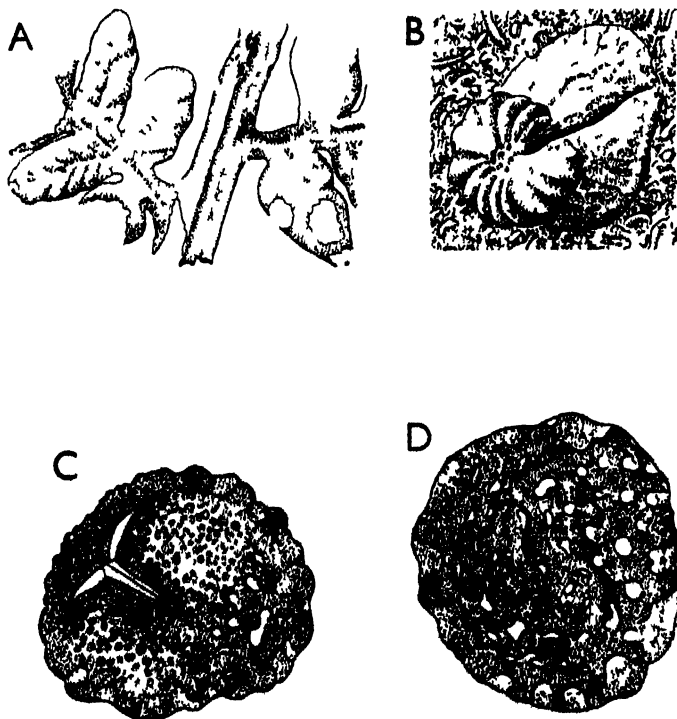
A, B, C, secondary segments from Leckenby 91 (fig. 1); that in A being partly covered by another segment in fig. 1, all $\times 2$. D, E, transfers of fertile pinnules showing the reflexed margins and sporangia almost buried in hairs. Witham Collection, V, 26903, V 26902, $\times 8$.

a particular pinnule were separately macerated and yielded fairly uniform numbers of spores, the basal sporangium having 372, the top 279, but a sporangium on another leaf had as few as 164. The spores are of

uniform sculpture and nearly all the considerable range in size is to be found in spores of a single sporangium.

No specimen shows the veins of the lamina, but in some of the sterile ones there are slight furrows in some of the pinnules (fig. 3, A) which suggest a midrib and

Fig 3



Klukisia arbus

A, surface of sterile pinnules showing channelled pinna rachis and slightly grooved pinnules, Leckenby Collection 86, $\times 4$ B, sporangium, from a transfer, Witham Collection, V 26903, $\times 50$ C, ventral side of a spore D, dorsal side of another spore, V 25840, $\times 500$.

simple lateral veins. Raciborski has figured forked lateral veins in sterile pinnules of "*K. acutifolia*" which appears identical with the present specimens.

Comparison.

1. *Yorkshire specimens*.—*K. exilis*, in the restricted sense, is a fairly uniform leaf. All of the numerous fragments I have seen match one or another part of the specimen in fig. 1, except that the segments are not always so crowded. The present material is identified as *K. exilis*, although the type-specimen was poor, because there seems to be no other Yorkshire fossil which, in the fertile state, can be confused with it.

Although the fertile leaves differ completely, the sterile leaves of *K. exilis* are rather like those of *Coniopteris arguta*, and the two have been much confused. Both were described under two or more specific names; a good fertile leaf of *K. exilis* was figured by Lindley and Hutton under the name *Pecopteris obtusifolia*, and sterile leaves of *C. arguta* have been figured as *P. acutifolia*, *P. serrata* and *P. lindleyana* as well. All these specific names seem to have been applied almost indiscriminately to fern fragments in the old collections. Several partially fertile (and therefore reliably determinable) specimens of *C. arguta* have been re-examined. Good specimens are clearly distinguished from *K. exilis* by the more profuse branching and larger primary segments of *K. exilis*, which is nearly tripinnate, while *C. arguta* is nearly bipinnate above, then becomes truly bipinnate and only approaches tripinnate in the lower parts of large leaves. The position of small fragments in the whole leaf is, of course, conjectural, but even these fragments are clearly distinguished. In *C. arguta* the substance of the lamina is thinner, the (forked) veins are seen clearly, the margin is not recurved and the underside is hairless.

There is another Yorkshire Pecopterid leaf, very possibly a species of *Klukia*, of which I have seen two poor specimens, one in the Reed Collection (York) and one in the Leckenby Collection (Cambridge). The pinnules are nearly twice as long, their margins are distinctly lobed but not reflexed: the lamina is thin and hairless and shows simple veins. The specimens look as though they had been fertile but have lost their sporangia.

The spores of *K. exilis* are remarkably rich in specific character. The spores of some thirty species of recent

Schizaeaceous ferns were examined for comparison. They are mostly large and many show bold ridges, but others have different ornamentation, and it appears to be possible to distinguish them by their spores alone. Several species of *Lygodium* have rather similar pits on the outer face, but they are without the little warts on the facets.

2. *Specimens of Klukia from other regions.*—All of the numerous Polish specimens figured by Raciborski under the names *K. exilis*, *K. exilis* v. *parvifolia* and *K. phillipsi* are regarded as distinct, though confirmatory evidence from the spores would be most welcome. The differences are: (1) there is no reflexed margin, and the sporangia extend so near to the edge as to leave little space for one. (2) The division between the pinnules extends to the midrib, while in every Yorkshire specimen the lamina is continuous. (3) Several of the Polish specimens differ also in having longer pinnules with more sporangia. On the other hand, Raciborski's "*K. acutifolia*" has small pinnules connected by a web of lamina, and although there is nothing to show whether the margin was reflexed, I consider it probably identical with the present specimens.

The Russian specimens described by Seward (1907), though not particularly good, appear to agree with this species. In his Afghanistan specimens (1912) a reflexed margin appears to be present. Good specimens were described by Prinada, who recognised the reflexed margin and mistakenly supposed that this character separated them from *K. exilis*.

Although the Japanese specimens are too fragmentary to show well-marked specific characters, they certainly do show that the genus *Klukia* occurred there in Jurassic times.

The specimens figured by Kryshstofovich (1916) are rather obscure. They appear to be sterile, and the largest, at any rate, differs from the Yorkshire ones and agrees with the Polish ones in having completely divided pinnules. All are therefore regarded as probably distinct. The position of the sterile leaves tentatively identified by Halle (1913) from the Middle Jurassic of Antarctica, and by Antevs (1919) and Johansson (1922) from the Lower Lias and Rhætic of Sweden, is obscure. Most of these specimens match Yorkshire ones in gross features, but no fine details are available. The gross form of *K. exilis* fragments is not very characteristic and

the agreement is inconclusive, and these records are, therefore, not accepted as evidence of the occurrence of *Klukia* in these floras. No opinion is expressed about the records of *K. exilis* without the evidence of figures from Austria (Krasser, 1908), Madagascar (Zeiller, 1900), Russia (Thomas, 1911).

Thus it can be said that *Klukia* is at present only known with certainty from Middle and Upper Jurassic rocks of Europe and Temperate Asia.

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20. *Otozamites bunburyanus* Zigno.
(Figs. 4, 5.)

1852. *Otozamites Bunburyanus* Zigno, p. 11.
 1853. *Otozamites Bunburyanus* Zigno, p. 348. (This and the above references have not been consulted by me.)
 1864. *Otopteris tenuata* Leckenby, p. 79, pl. ix. fig. 3. (Leaf-fragment from Yorkshire.)
 1868. *Otozamites Bunburyanus* Zigno, p. 9, figs. 4, 5. (Italian leaf-fragments; discussion of name.) *
 1875. *Otozamites tenuatus* Leck., Phillips, p. 221. lign. 46.
 1875. *Otozamites Bunburyanus* Zigno, Saporta, p. 128, pl. xxv. figs. 3, 4. (Copy from Zigno.)
 1881. *Otozamites Bunburyanus* Zigno, p. 102, pl. xxxviii. figs. 1-8. (Good Italian leaves.)
 1900. *Otozamites Bunburyanus* Zigno, Seward, p. 211, pl. ii. figs. 4, 5. (Leaf-fragments.)

The following determinations are doubtful :—

1879. *Otozamites Bunburyanus* Zigno, Feistmantel, p. 211, pl. vii. figs. 5-8; pl. xvi. fig. 2. (Very narrow leaf.)
 1891. *Otozamites Bunburyanus* Zigno, Saporta, p. 460, pl. cxcviii. fig. 1. (Fairly good leaf, Bathonian of France.)
 1901. *Otozamites Bunburyanus* Zigno, var. *major* Roth, Kurtz and Burckhardt, p. 14, pl. iii. fig. 7. (Ill-preserved fragment, Lias, Argentine.)
 1903. *Otozamites Bunburyanus* Zigno, Möller, p. 15, pl. ii. figs. 14, 15. (Leaf-fragment, Middle Jurassic, Bornholm.)
 1920. *Otozamites Bunburyanus* Zigno, var. *indica* Seward and Sahni, p. 28, pl. v. figs. 45-46. (Very narrow leaf, Jurassic, India.)

The following is definitely distinct :—

1932. *Otozamites* sp. aff. *Bunburyanus* Zigno, Carpentier, p. 7, pls. ii., iii. (Structural material, Corallian, France.) (Re-described by Florin, 1933.)

Introduction.—*Otozamites bunburyanus* is known from some large specimens from the Italian Oolite and some less good ones from other regions, including Yorkshire. No details have been described, and even the veins have been only roughly sketched. It appears to be a reduced and xeromorphic species, differing a good deal from most of the genus, but linked with them by the less reduced *O. beani*. There are a few similar-looking leaves which need fuller description before they can be satisfactorily distinguished.

The present specimens are on three blocks of shale, one of which is localised as Haiburn Wyke (Lower Estuarine). The specimens form part of the Reed Collection in the Yorkshire Museum, and I am indebted to Mr. R. Wagstaffe for lending me them.

Description.—Each block shows a number of nearly parallel leaves, all the same way up. One shows fourteen, one six, and one four leaves. The bases are broken off, but it looks as though they might have sprung from a common stem.

The lowest part of the petiole preserved is 7 mm. wide and it soon narrows to 3 mm., where the first segments arise. From here the rachis tapers very gradually to its apex. No specimen shows the whole length of the leaf, but the length was estimated at 30 cm., bearing in mind the width of the rachis in different fragments. The back of the rachis is densely covered with hairs; the petiole has rather coarse longitudinal ridges and the rachis fine ribs running most of its length along the back.

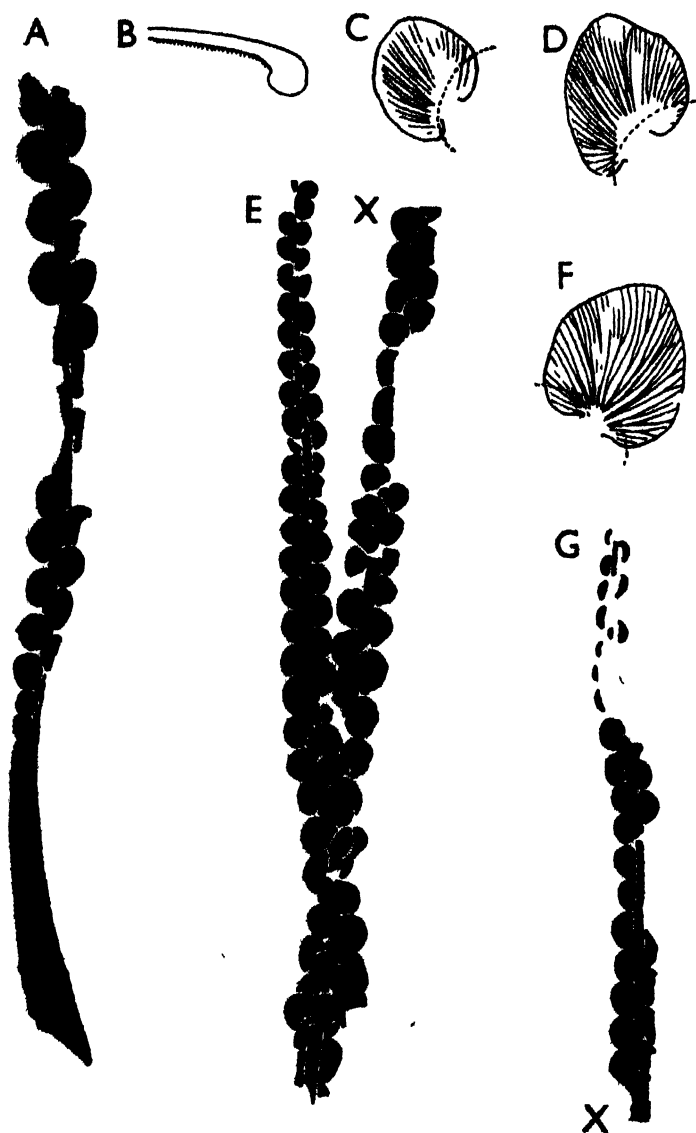
The segments from top to bottom of a leaf and in different leaves are remarkably uniform; the whole range is figured. The base of attachment is oblique, there is a suggestion of a very obtusely-pointed apex, and the two sides are symmetrical. In the middle of the leaf, nearly half a segment lies over the rachis and its base is always hidden by the segment of the opposite side; segments on the same side may be separated by small gaps or may overlap. The upper surface of the segments is somewhat convex and is nearly always the one exposed. The under (seen in transfers) is covered with short, fine hairs, giving it a brown colour, and the margin is prominent, being most strongly developed round the outer edges of segments. The cuticle is crushed along the margin, but not folded to any extent, showing that the margin, though thickened and standing out, is not reflexed.

The restoration shown in fig. 4 B is based partly on the transfers and partly on the widths of the different parts of the cuticle in the marginal region.

The veins form rather obscure ridges on the upper side and are almost hidden by the hairs on the lower side. They branch freely to maintain a high concentration, 5-7 per mm.

Cuticle.—The cuticle of the lamina is of medium thickness and is well preserved. The thickness (measured in folds) of the upper side is about $1.5\ \mu$, but by the margin it is $4\ \mu$. Most of the underside is barely $1\ \mu$, but the hairs are thicker at $1-3\ \mu$.

Fig. 4.

*Otozamites bunburyanus.*

(For explanation of lettering see opposite page.)

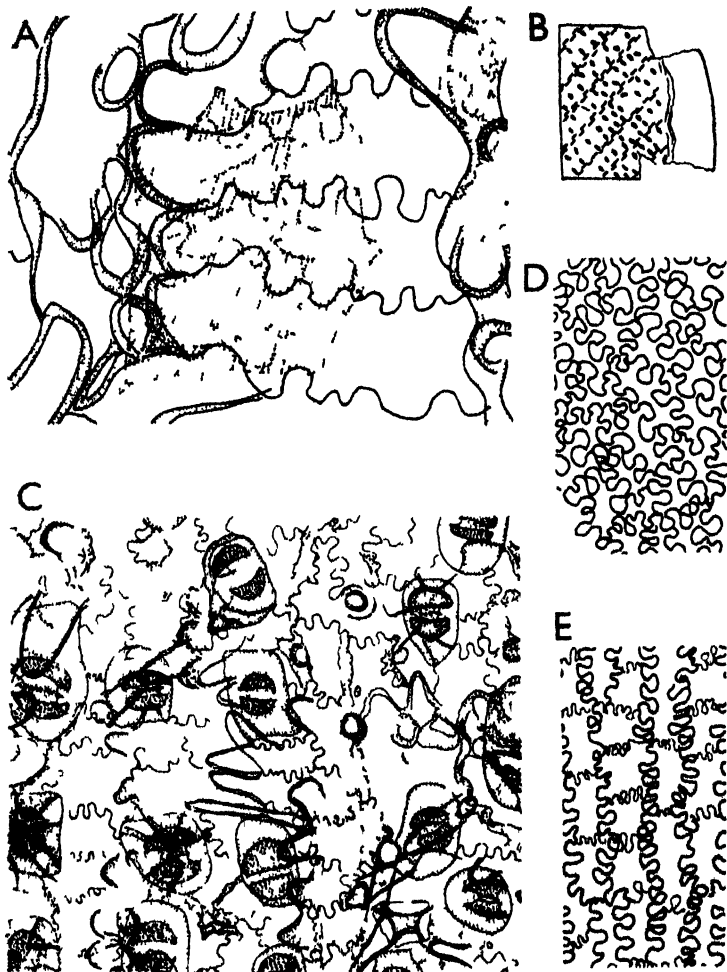
The upper cuticle is composed of nearly uniform cells, placed in rows parallel to the veins, which are scarcely distinguished. The lateral walls are strongly marked and very sinuous, the end walls less conspicuous and less sinuous. There is no papilla, the surface is flat and the chief surface markings are thin places in the loops of the side walls. There are no trichomes or stomata. At the edge of the leaf this cuticle changes slightly into that of the margin, where the cells are more coarsely sinuous, so that their interiors are almost obliterated.

The lower cuticle (apart from the margin) has numerous stomata, 100–120 per sq. mm., confined to the strips between veins. The vein strips are usually narrower than the stomatal strips. In the stomatal strips the stomata are rather irregular but often form about two longitudinal files (sometimes only one, sometimes three). They are irregularly spaced, but their mouths are roughly transverse.

The epidermal cells are hard to see. Their outlines are rather faintly marked and are confused by folds due to crushing and by the conspicuous papillæ. Along the veins they are roughly square, between the veins they are often about twice as broad as long. The walls are everywhere sinuous. The surface of most cells shows folds, as though it was originally convex, and folds are seen along the sides of veins showing that the veins were prominent. Most cells, perhaps all cells, bear a conspicuous, hollow cutinised papilla or hair, which may be a hemispherical bulge, but often forms a tapering hair up to 500μ long. These hairs often converge over the mouth of the stomatal pits. Both guard-cells and subsidiary cells are sunken. In the stoma figured, which is typical, the epidermis extends right across the stoma

A, lower part of leaf, block "A," $\times 1$. B, imaginary section through leaf-margin, showing distribution of hairs, $\times 10$. C, segment from near the top of a leaf, block "B," $\times 4$. D, segment from the middle of a leaf, block "A," $\times 4$. E, Middle and upper parts of two adjacent leaves, that on the right is continued in G, block "B" $\times 1$. F, segment from near the base of a leaf, block "A," $\times 4$. In this figure and in C and D, the pinna margin where distinct is indicated by dots, and the pinna below, which was dissected away, is indicated by a broken line. G, see E, top of leaf; the points X, X, in E and G are the same.

Fig 5

*Otozamites bunburyanus.*

- A**, a stoma from outside. Structures on the surface are drawn by a firm line, those seen through a layer of cuticle by a broken line. The guard-cells and subsidiary cells are stippled in oblique lines, slide B, $\times 800$. **B**, fragment of lower cuticle including marginal area. The stomatal apertures are shown by black ovals, the veins by broken ruled lines and folds due to crushing are also shown, $\times 20$. **C**, lower cuticle, showing two veins and parts of three stomatal bands, slide A, $\times 200$. **D**, cuticle of margin (underside), slide B, $\times 200$. **E**, upper cuticle, slide A, $\times 200$.

and then turns in to the stomatal pit at one side, the outlines of epidermal cells (presumed to be the same ones) are thus traceable on both upper and lower sides of the roof of the pit. The pit opens by a narrow crack, obliterated here and there by the bulging surface of epidermal cells. The subsidiary cells are small, but the guard-cells are developed normally.

Other stomata differ in having a wider opening of the stomatal pit, but in these it is covered by the large epidermal papillæ; the mouth of the pit is rarely open and exposed. Sometimes the opening of the pit is over that of the stoma, but it is more often to the side as figured.

Although no specialised trichomes have been observed (that is, apart from the small hairs on ordinary epidermal cells) there are a few small oval cells which might be trichome bases.

Discussion.—The peculiarities of *O. bunburyanus* can be regarded as xeromorphic. The leaflets are remarkably small, their veins are very crowded, and the margin is bent so as to reduce the undersurface. All these characters are common in small-leaved xerophytes. The cuticle also is xeromorphic: the stomata are protected firstly by their position in the furrows between veins, secondly by the epidermal hairs, and thirdly by the deep and narrow-mouthed stomatal pit. The stomata are unusually concentrated, but this high concentration, curiously enough, is frequent in small-leaved xerophytes.

O. beani serves to link *O. bunburyanus* with the rest of the genus. *O. bunburyanus* could, in fact, be regarded as having arisen from *O. beani* by xeromorphic reduction in various respects. The leaflet is reduced in size and also relatively shortened so that the outer half balances the basal lobe, making them round and symmetrical. The underside is, as it were, contracted, so as to pull the edge over and make the thickened margin, and while the lower epidermal cells of *O. beani* bear a small papilla, here the papilla is large, sometimes forming a short hair.

Determination.—Zigno's original Italian specimens were good ones and seem to have been carefully figured. The present specimens look just like Zigno's figures and are therefore identified, although nothing is known about the structure of the Italian specimens. They are identified

with other Yorkshire specimens figured under the names *O. tenuatus* and *bunburyanus*, although they are rather poorly preserved, because they agree as far as can be seen and because there seems no other species in Yorkshire with which they can be confused. The most similar are *O. beani* (L. & H.), which is easily distinguished by its elongated leaflets and by its cuticle (see Harris, 1944), and *O. feistmanteli* Zigno (see Seward, 1900, p. 221). No Yorkshire specimen of *O. feistmanteli* has yet been figured, but the name is used for leaves with small segments like those of *O. bunburyanus* but slightly longer. Thomas and Bancroft describe the outicle of Yorkshire *O. feistmanteli*, it has crowded stomata, but they are not concealed in pits and the lower epidermis is not hairy.

Comparison.—Although *O. bunburyanus* has unusually small leaflets, a number of more or less comparable species have now been described. Several of these have been listed above (as unaccepted determinations), and others slightly less similar have been described under the specific names *mandelslohi* Kurr, *massalongianus* Zigno, *bengalensis* O. & M., *crassifolius* Lignier, all cited as possible synonyms of *O. feistmanteli* by Seward, 1900, p. 221. There is, in addition, *O. marginatus* Saporta, 1873. None of these species can be compared fully in the absence of detailed information, but in none are the leaflets of the shape of a typical one of *O. bunburyanus*. Any of them, particularly the ones which have been determined as *O. bunburyanus*, could perhaps be regarded as a more or less abnormal leaf of that species, but such a determination has obviously little value. No doubt most or all will prove different when investigated.

The position of *O. sp. aff. bunburyanus* of Carpentier (re-described by Florin, 1933) is different. This leaf, known from a petrefaction in great detail, does differ in certain important respects: the margin is unthickened, the veins less crowded and the stomatal pit is not constricted at its mouth.

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21. A coprolite of *Caytonia* pollen. (Fig. 6.)

1829. "Small vegetable bodies in groups." Phillips, pl. vii. fig. 25. (*Teste* Fox Strangways.)
1875. Phillips (as 1829).
1880. "Too obscure to deserve naming" (*Sphæreda parvula*), Nathorst, p. 71.
1892. *Sphæreda parvula* Bean MS., Fox Strangways, p. 141. (*Nomen nudum* and record of occurrence.)

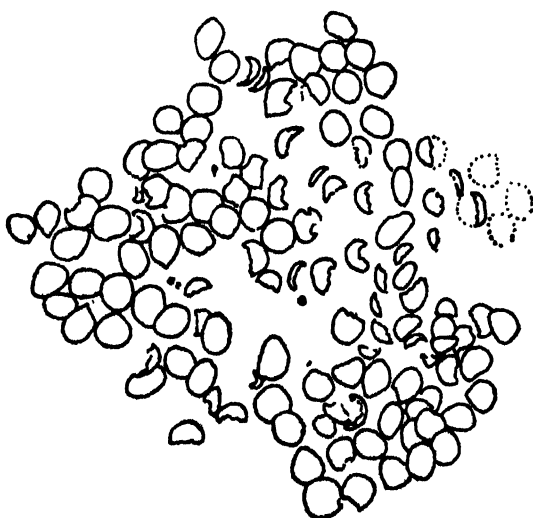
Among the Jurassic plants in the York Museum is a specimen showing two groups of roundish black bodies, one group (figured) comprises slightly more than a hundred bodies, the other slightly less. It looks as though it might be some sort of fructification and was evidently taken as one, as it bears the early label "*Sphæreda parvula*, Bean," and later label "*Beania (Sphæreda) parvula*, Bean." This name recalls *Beania gracilis* (also called *Sphæreda paradoxa*), a cone with seeds slightly like these bodies. There is, however, no visible connection between the bodies in the present fossils, and evidence is given later that it is a group of pellets of fossil dung.

The specimen is unlocalised (apart from a label "Near Scarborough" which was applied indiscriminately). The

original label gives the formation as "Upper Shale," which the later label translates as "Middle Estuarine." There is strong evidence that it is from the Gristhorpe Bed (Middle Estuarine).

Associated with the collections of pellets are a few determinable fossils, all of which were confirmed by cuticle preparations. These are *Sagenopteris phillipsi* Brongn. (3 leaflets), *Caytonanthus arberi* (Thomas) (2 isolated anthers), *Allicospermum retemirum* Harris (1 seed),

Fig. 6.



Group of coprolites, natural size.

Klukia exilis (Phillips) (numerous isolated spores in the matrix). It happens that all of these species occur in the Gristhorpe Bed, but have not been reported from the other classic Middle Estuarine locality, Cloughton. Further, Dr. Hamshaw Thomas tells me he collected coprolites of just this type in the Gristhorpe Bed.

I am indebted to Mr. R. Wagstaffe for lending me the specimen for description.

Description.—The fossils are on a single bedding plane of a block of shale, 9 cm. \times 15 cm. It is noteworthy that this bedding plane is not flat, but gently undulates, and this is taken to be ripple marks. The group of

pellets not figured is just like that figured, and is adjacent to it, but the individual pellets are more scattered. The pellets are mostly round or oval; some show a very obtuse point at one end. They are rather thick, about 0.1 mm. in the middle, but thin at the edges. Their diameter varies from 3-6 mm., many are about 4 mm. The surfaces are flat or slightly uneven and a dull black, unlike most fossil plants in this series.

Where the pellets are crowded one overlaps another. This overlap may imply that they were originally flattened, perhaps lenticular rather than sphaeroidal. For the most part they form a single layer, but in the middle of the figured group they seem to be two or three deep, though here they are not well shown.

Fragments of several pellets from both groups were macerated. All yielded plant cuticles and pollen grains of *Caytonanthus arberi* in surprising numbers. The cuticles are of several kinds, but all in small fragments (about 0.5 mm. long) and packed together in as many as twenty layers, while the pollen is evenly distributed as isolated grains. A certain amount of coaly matter cements all these cuticles and is dissolved by the maceration. The cuticles are often folded, and little rolls were seen with the cuticle inside out.

The origin of the cuticles could not be fully settled. Very few leaves are represented: one pellet gave a small fragment of *Sagenopteris phillipsi*, another several fragments of a Ginkgoalean leaf, probably *Ginkgoites digitata*. Most of the cuticles show no stomata and presumably belong to stems or petioles. Many of them could well belong to the anthers or sporophyll branches of *Caytonanthus arberi*, but are hardly characteristic enough to determine. The pollen grains, however, are determinable with certainty; many are beautifully preserved and are, indeed, the best I have seen, and their shape, measurements and surface markings are typical. Other pollen grains, however, are thinly cutinised, and still others only doubtfully recognisable: these are thought to be young ones of the same kind. No other species of pollen or spore was seen.

Although the *C. arberi* pollen is always abundant, the number of grains varies. In one pellet from the figured group, the number was estimated from very rough counts

of samples to be about 200,000 in the pellet. However, one from the other group had only a few thousands. If the pellets were spherical, the volume of these 200,000 grains should be about 2 per cent. of the whole pellet.

There is no sand or similar mineral in the pellets.

These facts can be explained on the hypothesis that the fossil consists of the dung of a herbivore that had eaten microsporophylls of the *Caytonia* plant and certain other food. Dr. Hamshaw Thomas tells me he also reached this conclusion with some similar material he investigated a good many years ago. He described his work at a scientific meeting but no report was printed.

On this view the fossil dung may be compared, for example, with goat dung, for in this animal the slightly pointed pellets are formed in the hind gut and then discharged in numbers together: a particular goat was observed to discharge 60. The two groups of pellets would represent successive discharges, and the fact that they have not been scattered by water suggests that they were dropped into soft mud left by the temporarily receding waters. The bedding plane appears to be ripple-marked.

I examined the dung of a rabbit and a goat to learn something about digestion in herbivores. The plant material was recovered by washing after simple extraction with dilute alkali, and afterwards by the full maceration used to prepare the fossils. The plants were very differently preserved, although the two animals were given the same diets. In both, lignified fibres are undigested, and so is cork (from tree bark) and certain thick cuticles (*Pinus sylvestris* leaf). With rather thinner leaf cuticles (leaves of a variety of *Rubus fruticosus* growing in the open) the cuticles were recognised with some difficulty in the goat, easily in the rabbit; with a thinner cuticle (leaves of a woodland variety of *Rubus fruticosus*) the cuticles were hardly to be recognised in the goat, but still easily in the rabbit. Still more delicate cuticles are lost in both. It was noticed, too, that much cellulose tissue was undigested in the rabbit but virtually none in the goat.

Both animals were fed with pollen. *Cedrus libani* pollen was dusted over their food: the grains were recovered from both in apparently excellent preservation.

A large quantity of mixed and undetermined pollen collected by bees (and left as residue after wax extraction) was made into cakes with flour and treacle and fed to both. Abundant pollen grains of many types were recovered from the rabbit, but while some were recovered from the goat, other types were not found.

It is clear, therefore, that a herbivore is liable to digest the more delicate cuticles, and that some herbivores destroy cuticles more than others do. The composition of the dung may thus not reflect the composition of the food.

The fossil dung includes some fairly delicate cuticles in good preservation; it is clear, therefore, that the animal's digestive powers for cuticle were less powerful than those of the goat. It is fairly safe to say that the animal had not been eating many thickly cutinised leaves as their cuticles would have been recovered, but it might have eaten great quantities of delicate leaves which would leave hardly a trace. The leaf of the *Caytonia* plant (*Sagenopteris phillipsi*) has a rather delicate cuticle, and the fact that only a single fragment of that leaf was found does not prove that the animal did not eat it in large quantities.

The diameter of the dung pellets in the rabbit and goat is determined by the normal internal diameter of the hind gut: it is about 10-14 mm. in a mature specimen of both. In the present fossil it is only 4-5 mm. The total quantity of dung represented by the pellets seen on this piece of rock (assuming them spherical) is of the order of 10 c.c.; far less than is discharged in the goat at a time, but probably more than by the rabbit.

It is attractive to speculate about the animal which produced this dung; facts are few and allow fantasy wide limits. However, it is not quite hopeless to look for further evidence; footprints might be related to the coprolite and these to a skeleton. When this has been done it is strongly urged that the palaeontologists should not regard the specimen figured here as the type, nor use the name *Sphæreda parvula* for it. "*Sphæreda parvula*" was merely one of the *nomina nuda* which Bean gave the unknown fossils he discovered. Neither Phillips's figure (which Fox Strangways identifies with "*Sphæreda parvula*") nor the one given here constitute a description;

a coprolite is not an organism and does not merit a generic and specific name.

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XXXVI.—*Two Notes on Trematodes.* By STEPHEN PRUDHOE, Department of Zoology, British Museum (Natural History).

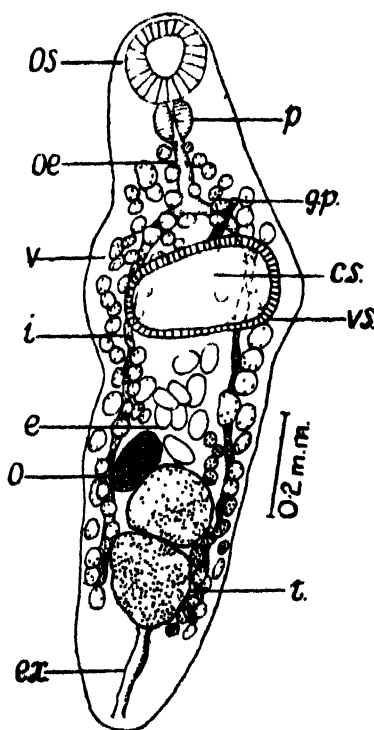
1. *Plagioporus protei*, sp. n. (Fig. 1.)

A few years ago Mr. R. S. Hawes brought to England from Yugoslavia some live specimens of the olm (*Proteus anguinus*) captured at Vir Pri Stični, near Ljubljana, Slovenia, and at Vjetrenica Pečina, Popovopolje, Herzegowina. Dr. H. A. Baylis arranged with Mr. Hawes for the writer to examine the *Proteus* for worm-parasites. Of five specimens examined, two, one from each locality, were found to harbour a few trematodes in the small intestine. The worms appear to belong to the genus *Plagioporus*, and are thought to represent a new species, of which the following is a description :—

The body is plump and somewhat fusiform in shape. It varies between about 0.8 mm. and 1.4 mm. in length and between 0.3 mm. and 0.45 mm. in maximum width, which occurs in the region of the ventral sucker. The cuticle is smooth, and sufficiently transparent to allow the internal organs of the living worms to be readily seen. The ventral sucker is prominent, and situated a little in front of the middle of the body. It is transversely oval in specimens preserved in formalin, and measures 0.18–0.24 mm. × 0.27–0.30 mm., while the subterminal oral sucker is more or less rounded, varying from 0.12 to 0.2 mm. in diameter. The pharynx is rounded, and measures 0.06–0.08 mm. in diameter. The oesophagus measures up to 0.13 mm. in length and almost invariably extends for a

distance of about 1/11 of the total length of the body. The intestinal bifurcation is situated at, or a little in front of, the anterior border of the ventral sucker. The intestinal cæca are relatively narrow, and extend to about the posterior sixth of the body. The excretory vesicle is

Fig. 1.

*Plagioporus protei*, sp. n.

Ventral view. c.s., cirrus-sac; e., eggs; ex., excretory vesicle; i., intestinal caecum; g.p., genital pore; o., ovary; œ., oesophagus; o.s., oral sucker; p., pharynx; t., testis; v., vitelline follicles; v.s., ventral sucker.

tubular, extending anteriorly to about midway between the ventral sucker and the posterior extremity of the body. The genital pore lies to the left of the median line in the region of the intestinal bifurcation. The elongate cirrus-

sac is very thin-walled, and extremely difficult to make out in whole preparations, owing to vitelline follicles lying for the most part dorsally and ventrally to it. In serial sections, however, it appears to consist of two very thin layers of muscle-fibres, enclosing a large coiled seminal vesicle and a few prostatic glands. A pars prostatica does not seem to be differentiated. The cirrus-sac extends to about the middle of the ventral sucker, and varies between 0.18 mm. and 0.23 mm. in length and between 0.05 mm. and 0.06 mm. in maximum width. The testes are arranged one directly behind the other, with the posterior testis lying between the ends of the intestinal cæca. In contracted specimens, however, they may assume an oblique disposition, and in one much flattened and contracted specimen they are arranged side by side. Normally the testes are more or less rounded, but after fixing in 5% formalin they sometimes appear irregular in outline. Their diameter varies between 0.12 mm. and 0.18 mm. The ovary lies to the right of the median line immediately in front of the anterior testis. It is oval and measures 0.06–0.1 mm. \times 0.075–0.13 mm. A receptaculum seminis was not made out. The vitelline glands consist of numerous relatively large follicles arranged laterally, and extending from the œsophagus to the testes. Anteriorly to the ventral sucker the follicles are confluent in the median line, dorsally and ventrally, while the posterior limit of the follicles varies between the anterior border of the foremost testis and the posterior border of the hinder testis. The uterine coils are few, and contain up to about twenty eggs, measuring 0.067–0.075 \times 0.045–0.050 mm.

Price (1934) regards the genus *Lebouria* Nicoll, 1909, as a synonym of *Plagioporus* Stafford, 1904, and among the species he transfers to the latter is *Lebouria nicolli* Issaïtschikow, 1928. In this species, as in the present species, the intestinal cæca and vitelline follicles do not extend posteriorly beyond the hinder testis, whereas in the genotypes, *Plagioporus serotinus* Stafford and *Lebouria idonea* Nicoll, these organs pass beyond the hinder testis, and posteriorly the vitelline follicles are confluent in the median line. Principally because of these differences Issaïtschikow (1928) proposes the subgenus *Caudotestis* for *Lebouria nicolli*, but Yamaguti (1934) raises the subgenus to generic

rank, and adds three new species. Miller (1940), however, regards *Caulotestis* as a synonym of *Plagioporus* on the grounds that the generic differences are not sufficiently clear, species of both genera showing all the intermediate gradations.

The present species appears to bear a close resemblance to *Plagioporus sinitsini* Mueller, 1934, from the gall-bladder of freshwater fishes in North America, and *P. gnathopogonis* (Yamaguti, 1934) from the intestine of freshwater fishes in Japan. *P. protei* may, however, be distinguished from the former mainly by the disposition of the vitelline follicles in the anterior region of the body, and from the latter mainly by the ratio of the suckers and the size of the eggs.

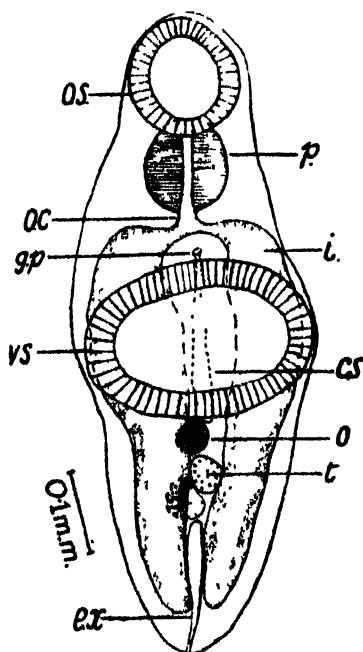
2. *Peracreadium* (?) sp., from a Polyclad Turbellarian.
(Fig. 2.)

While studying serial sections of a portion of a polyclad belonging to the genus *Planocera*, which had been collected about the year 1887 at Port Phillip Bay, Victoria, Australia, the writer came across sections of four immature trematodes lying free in the lumen of the main-gut. In addition, three complete immature worms were dissected out from the posterior intestinal branches of the unsectioned portion of the same specimen. The polyclad had been preserved in alcohol for nearly sixty years, and the condition of the parasites would not allow a critical study of their anatomy, but sufficient detail has been made out to place them in a single species, which may be assigned to the family Allocreadiidae, as will be seen from the following description:—

The body is somewhat fusiform in shape, measuring 0.78–0.9 mm. in length and 0.31–0.34 mm. in maximum width. The cuticle appears to be without spines. The ventral sucker is situated in the middle region of the body. It is rather prominent and transversely oval, measuring 0.19–0.22 × 0.28–0.3 mm. The subterminal oral sucker is rounded, and measures 0.14–0.16 mm. in diameter. The pharynx is relatively large, measuring 0.1–0.12 mm. in transverse diameter. A short oesophagus bifurcates in front of the ventral sucker. The intestinal caeca are wide, and extend to near the posterior end of the body. The excretory vesicle is tubular, and runs anteriorly for a

distance of about one-fifth of the total length of the body. Opening into the anterior extremity of the vesicle are two narrow canals, which extend to the region of the pharynx. The genital pore lies in the median line between the intestinal bifurcation and the ventral sucker. The cirrus-sac is slender and relatively long, extending posteriorly to the ovary. It contains a large seminal vesicle, a short

Fig. 2.

*Peracresadium* (?) sp.

Ventral view. Lettering as in fig. 1.

pars prostatica, and a fairly long unarmed cirrus. The testes are more or less obliquely arranged, and lie dorsally to the intestine cæca, in front of the excretory vesicle. The ovary is situated immediately in front of the testes. The vitelline glands are not yet developed.

Nicoll (1909) has given a table showing the differences between several closely-related genera which he considers

to belong to the subfamily Allocreadiinae. The characters of the present specimens agree rather well with those enumerated by Nicoll for *Peracreadium*, but as the specimens are immature, in so far as the vitelline glands are not yet developed, the species cannot be definitely assigned to this genus.

It is interesting to note that the specimens were not encysted, and appeared to have been ingesting food taken from the intestine of the host. Whether or not they would have become sexually mature in the polyclad is, of course, open to question, but there are recorded instances of members of the Allocreadiidae attaining sexual maturity in invertebrate hosts, and Graff (1892) records the discovery of a sexually mature "*Distoma*" in the intestinal branches of *Planocera simrothi*. Apart from stating that the "*Distoma*" is only 0.22 mm. long and 0.06 mm. wide, Graff has given no description of the worm, but by reason of size alone it appears very unlikely that his form is specifically identical with the present specimens.

Graff (1903) gives only three references in which polyclad turbellarians are recorded as hosts for trematodes. Two of the records refer to metacercariae found in *Leptoplana tremellaris* and in *Planocera pellucida*, while the third refers to the above-mentioned "*Distoma*" in *Planocera simrothi*, and so far as the writer is aware no further instances have been recorded.

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XXXVII.—*Descriptions and Records of Bees.*—CXCVIII.

By T. D. A. COCKERELL, University of Colorado.

Halictus geteinus, sp. n.

♀.—Length about 5.5 mm., anterior wing 3.7 mm.; black, with greyish-white pubescence; mandibles slightly brownish; flagellum dusky reddish beneath except at base; head broad; sides of face and front with conspicuous white hair; clypeus and supraclypeal area polished; mesonotum shining, thinly hairy; scutellum highly polished, not evidently depressed in middle; postscutellum densely covered with pale tomentum; area of metathorax moderately large, shining, with strong plicæ (rather in the style of *H. libericus* Ckll., but the area more shining apically); tegulæ reddish, with a shining red boss; wings hyaline, stigma and nervures very pale; outer nervures weakened; second submarginal cell rather broad, receiving recurrent nervure some distance from end; basal nervure almost meeting nervulus, legs black, with much white hair, tarsi reddish apically; abdomen stout, polished, hind margins of tergites faintly brownish; first tergite with a patch of light hair on each side, second and third with lateral patches, fourth with a thin inconspicuous basal band.

Mesonotum densely punctured, as seen under microscope, the punctures not nearly a puncture width apart. Hind spur pectinate.

Sudan: Geteina, April 16, 1928, from melon flowers (*H. B. Johnston*, C. 10984). Also one from Atana, June 28, 1923, on *Bamia* (*H. B. Johnston*). Geteina (or El Geteina) is about 20 miles S.S.W. of Khartoum. In my key to *Halictus* of Morocco this runs nearest to *H. rufotegularis* Ckll., which is considerably larger, and does not have the distinct hair-patches on abdomen. The pale stigma and other characters at once separate it from *H. interruptus* Panz.

H. transitorius Schk. (*planulus* Pér.) is separated by the pale margins of tergites and the reddish tarsi.

Halictus duplopunctatus, sp. n.

♀.—Length about 6.5 mm., anterior wing 5; black, including mouth-parts and legs; flagellum dusky red

beneath; tegulae almost black, faintly brownish; pubescence white, dense at sides of face and front, but not on cheeks; mesonotum bare, with a narrow marginal hair-band at sides and behind. the large postscutellum densely covered with white tomentum; mesopleure hairy, with the upper part bare. head broad, vertex not elevated, clypeus not produced, clypeus shining, with a deep median groove, supraclypeal area moderately shining, mesonotum and scutellum shining, the mesonotum (seen under microscope) has scattered extremely minute punctures, and widely spaced much larger ones. area of metathorax large, dull, smooth, with very delicate (microscopical) plicae at base: hind spur with three blunt spines, and a long apical portion (style of *H. plicatus* (Kll.); abdomen stout but parallel-sided, shining black, the second tergite brownish apically. first tergite with a very little white hair at sides, but no band: second with white hair at sides of base, third with basal and apical bands, fourth with an apical band.

Sudan: Shambat, June 19, 1930, on berseem (*H. W. Bedford*, C.10991). This runs out in all tables, falling near such species as *H. frigesens* Kll., and *H. eurygnathus* Bluthgen. The sculpture of the mesonotum, with larger and smaller punctures, like the stars in the sky, is distinctive.

Halictus denselineatus, sp. n.

♀.—Length about 5 mm., anterior wing 4.2; black, with the mandibles red except at base, antennae dark, the flagellum brownish beneath; tegulae small, red; legs dark; abdomen broad and short, shining black, without hair-bands; head broad; clypeus with a large triangular somewhat shining area; sides of face not evidently hairy; mesonotum and scutellum dull, postscutellum with dull white hair; area of metathorax large, moderately shining; wings hyaline, faintly greyish, stigma and nervures very pale; first tergite polished.

The following characters are microscopic: mesonotum minutely and densely striate, with well-spaced very small punctures; area of metathorax smooth, the basal half with irregular spreading plicae; first recurrent nervure interstitial.

Sudan: Sawleil, March 6, 1929, on cotton plant (*A. M. Makkawi*, C. 11033). A common-place looking little

species, but distinct by the peculiar sculpture of the mesonotum. It runs near to *H. pauxillus* Schenck, which I have taken in Morocco.

Halictus postnitens, sp. n.

♂.—Length about 5.3 mm., anterior wing 4.4; black, slender, the mandibles, labrum, and a broad apical band on clypeus pale yellow; head rather broad, clypeus not produced; face and front densely covered with white hair; antennæ long, about reaching to metathorax, the flagellum clear red beneath, not black at end; mesonotum and scutellum brilliantly polished, the scutellum without an evident median depression, mesonotum with white hair in front, and a very slender marginal band at sides and behind; postscutellum with a band of white tomentum; area of metathorax very large, broadly truncate behind, highly polished, with only a little sculpture at extreme base; posterior truncation with sharp lateral margins; tegulæ pale testaceous; wings clear, strongly iridescent; stigma rather large, reddish brown; nervures brown, second submarginal cell receiving recurrent nervure a short distance from end; legs with the slender tarsi pale yellow, the tibiæ yellow with a large black mark; abdomen polished, the first tergite very brilliant; margins of tergites black; second to fourth tergites with inconspicuous basal hair-bands, on second and third very narrow except at sides, failing in middle, on fourth broader; apical part of venter with some white hair.

Sudan: Sawleil, F. P., March 6, 1929, by sweeping cotton (*R. S. Audas Bey*). It is numbered C. 10986.

In the keys, this seems to run to the vicinity of *H. interruptus* Pz., but while there are many points of resemblance, the metathorax of *interruptus* is entirely different. I do not know any other species with a metathorax like that of *H. postnitens*.

Halictus latifrontellus, sp. n.

♀.—Length about 5 mm., anterior wing 4.3; black, with the mandibles red in middle, and light yellow at base; flagellum dusky red beneath; head very broad, clypeus not produced, vertex not elevated, the ocelli on top of head; face and front with little hair, but cheeks and sides of thorax densely hairy; mesonotum bare, brilliantly

polished, but with hair-spots in front, and very weak marginal bands at sides and behind ; scutellum polished ; postscutellum with light hair ; area of metathorax large, shining, microscopically lineolate and somewhat reticulate, with a narrow band of plicæ at extreme base ; tegulæ pale testaceous ; wings clear hyaline, iridescent ; stigma light brown ; nervures pale, second submarginal cell receiving recurrent nervure a short distance from end ; small joints of tarsi pale reddish ; hind spur with three long sharp spines ; abdomen broad, shining, second and third tergites with cuneiform patches of pale hair at lateral bases, fourth with a slender band right across ; extreme tip of abdomen light red.

Sudan ; Sawleil, March 6, 1929, by sweeping cotton (*R. S. Audas Bey*, C. 11035. This is smaller than *H. postnitens*, but it may nevertheless be its female. I give it a different name, having no proof of this association. The heads are so very different that it is hard to believe it is merely a matter of sex.

Halictus laterocinctus, sp. n.

♂.—Length about 6.5 mm., anterior wing 5 ; black, the mandibles dark, the clypeus with a pale yellow apical band, the femora and tibiæ black, the basitarsi white and the small joints of tarsi light red ; face narrowed below, clypeus not very prominent : vertex, when head is seen from in front, hardly elevated above ocelli ; face and sides of front densely covered with pure white hair ; flagellum broken off in type ; mesonotum dull, thickly covered with pale grey hair, except the middle posteriorly ; a band of grey hair along hind margin of mesonotum ; scutellum moderately shining ; postscutellum covered with pale hair ; area of methorax short, with numerous regular plicæ, the surface rather glistening ; metathorax, excepting the area, densely covered with pale hair ; tegulæ pale testaceous ; wings long, clear hyaline, stigma and nervures pale reddish, the stigma small, with a slightly darkened margin ; second submarginal cell broad, but not as broad as third ; recurrent nervure interstitial ; abdomen shining ; first tergite with white hair at sides and base ; second and third tergites with white at sides, joining on second a basal band which is interrupted in middle, third tergite with both basal and apical bands ; fourth and fifth with apical bands.

Sudan : Dissa, Feb. 24, 1929, on shatta plant (*R. S. Audas Bey*). It is numbered C. 10992. The light basitarsi are as in *H. leucozonius* Schrk., but the long face and the thorax are entirely different. From its general appearance, this might seem to be the male of *H. shenlicus* Ckll., but that has red mandibles and very dark tegulæ, and no bands of white hair along sides of second and third tergites. In Bluthgen's table of Spanish species, it seems to go nearest to the much larger *H. holtzi* Schulz. I have this species from Cyprus, and it is quite different.

Halictus rubrocinctus, sp. n.

♀.—Length about 5.3 mm., anterior wing 4; black, robust, with broad abdomen, mandibles obscurely reddish; flagellum red beneath, abdomen with the first two tergites broadly bright red at apex, the margin to the third obscurely reddish, pubescence white, very scanty, but postscutellum densely covered with white tomentum; head rather broad; clypeus and supraclypeal area shining; mesonotum and scutellum polished; area of metathorax crescentic, not as long as scutellum; finely reticulate; although the mesonotum is shining, the microscope shows it to be densely punctured; tegulæ red; wings hyaline, very faintly dusky, stigma large, pale red, without dark margin, nervures very pale; second submarginal cell broad, quite as broad as third below, receiving recurrent nervure at the apical corner; legs mainly black, but the middle and hind tarsi red, and the tibiæ light at ends.

Sudan : Erkowit, May 22, 1917 (*H. H. King*, C. 4919).

Halictus magnipunctatus, sp. n.

♀.—Length about 5 mm., anterior wing nearly 5; black, with the broad abdomen entirely clear red, except a little dusky shade at apex; legs dusky red, the front tibiæ and the femora darkened; pubescence white, very scanty, but postscutellum densely covered with white tomentum; mandibles dark; antennæ obscurely brown beneath, the general effect entirely dark; head about circular seen from in front; mesonotum polished, but with excessively large punctures, much the largest I have seen in the genus; scutellum with similar large punctures; area of metathorax large, coarsely reticulate; hind spur with three long sharp spines.

Sudan: type from Artigashi, Jan. 23, 1915 (*H. H. King*, C. 4895). Also one from Erkowit, May 24, 1917 (*H. H. King*).

Halictus fusiferus, sp. n.

♀.—Length about 6 mm., anterior wing 4·5; black, with the fusiform shining abdomen clear bright red, without hair-bands or patches; head broad, the face and front thinly covered with dull white hair; flagellum dull red beneath; mesonotum shining, but well punctured, the punctures emitting hairs; area of metathorax large, reticulate; tegulae obscure reddish; wings long, dusky, with a very large red stigma; nervures brown; third submarginal cell very broad, receiving recurrent nervure at basal corner; legs black, the front tibiae and tarsi reddish.

Uganda: Kampala, 1927 (*G. L. R. Hancock*).

The above three species, with red or partly red abdomen, may be compared with those tabulated in 'African Bees,' p. 63. *H. magnipunctatus* is at once separated from all others by the immense punctures of the mesonotum and scutellum, and *H. fusiferus* by the fusiform abdomen, narrower at base.

The markings of the abdomen at once separate *H. rupeocinctus*, not only from the species tabulated, but also from such species as *H. sphecodimorphus* Vachal and *H. achrous* Blüthgen.

Halictus neavei, sp. n.

♀.—Length about 7·5 mm., anterior wing nearly 7; black, robust, with dull whitish hair, abundant on sides of thorax and on mesonotum, where it is quite long anteriorly; head subtriangular in outline, seen from in front; mandibles and antennae black, the flagellum short and thick; clypeus and supraclypeal area moderately shining, but not highly polished; mesonotum entirely dull; scutellum somewhat shining; postscutellum with erect head; area of metathorax dull, not plicate, broadly rounded behind, with no apical pit; tegulae very dark brown; wings dusky; stigma narrow, pale, with a darker margin; nervures pale brown; second submarginal cell broad, receiving recurrent nervure a short distance from end; third submarginal long, nearly as long as first; legs black, with the hind tarsi dusky reddish, the basitarsi blackish on outer side; hind spur not pectinate; abdomen

broad, dullish, without hair-bands; hind margins of tergites 1 to 4 pallid.

Nyasaland: Mlanje Plateau, 6500 ft., Dec. 18, 1913 (S. A. Neave). Although the abdominal bands are rather obscure, this must be associated with the species having tegumentary bands. The following key separates some E. African species:—

Mesonotum shining on disc	<i>andersoni</i> Ckll.
Mesonotum entirely dull	1.
1. Abdomen with broad, sharply defined, pale yellowish bands	<i>kavirondicus</i> Ckll.
Abdomen with narrow or linear bands	2.
2. Larger; bands white and sharply defined	<i>uberदारicus</i> Ckll.
Smaller; bands paler yellowish, not conspicuous.	<i>neavei</i> Ckll.

XXXVIII.—New or little-known Tipulidæ (Diptera).—

LXXIV. *Neotropical Species*. By CHARLES P. ALEXANDER, Ph.D., F.R.E.S., Massachusetts State College, Amherst, Massachusetts, U.S.A.

IN this paper I am considering various species from Ecuador, the materials having been collected by my friends, Messrs. F. Martin Brown, David Laddeyrd and William Clarke-MacIntyre, to all of whom I extend my deepest thanks. Through the courtesy of these entomologists I am privileged to retain the types of the new species in my collection.

Brachypremna abitaquæ, sp. n.

Size very large (wing, male, 30 mm. or more); mesonotum chiefly darkened, the præscutum with four stripes that are separated by paler interspaces; palpi with basal segment dark brown, the succeeding segments paler, the terminal one uniformly brownish black; antennæ with scape and pedicel yellow; legs with femora light brown on more than proximal half, thence deepening to black, the tips broadly whitened; tibiæ with base whitened, followed by a black ring occupying about one-third the length of the segment on all legs; remainder of tibiæ and the tarsi yellowish white; wings long and relatively narrow, fulvous-brown, restrictedly patterned with darker;

abdominal tergites chiefly dark brown, the lateral borders and basal rings paler; sternal dashes narrow, attenuated behind and not reaching the posterior border; male hypopygium with the tergite broadly notched medially; dististyle gradually narrowed to the obtuse tip.

Male.—Length about 19–20 mm.; wing 30–30.5 mm.

Frontal prolongation of head unusually tumid or bulbous, yellow above, including the very long nasus that is tipped with golden setæ; ventral half of prolongation dark brown; palpi with the first segment dark brown, segments two and three paler brown with narrow yellow incisures; terminal segment uniformly brownish black. Antennæ with scape and pedicel brownish yellow, clearer on the inner faces; flagellum blackened. Head chiefly brown, the front, narrow posterior orbits and a very narrow median vitta more yellowed.

Pronotum with four brown areas that are separated by narrow yellow pollinose lines. Mesonotal præscutum chiefly occupied by four brown stripes, the intermediate pair a trifle more reddened than the laterals; lateral præscutal border behind the pseudosutural fovea more yellowed; scutum, including its median area, dark brown; scutellum obscure brownish yellow with a central brown spot, parascutella uniformly darkened; mediotergite patterned with three darker brown stripes, the broad central one narrowed posteriorly and here subtended by two more greyish yellow spots; pleurotergite with the anapleurotergite chiefly brown, the cephalic fourth and most of the katapleurotergite whitish pruinose. Pleura greyish white, patterned with brown, more extensively so on propleura and mesepisternum; sternopleurite with an 8-shaped brown marking; mesepimeron and metapleura almost uniformly whitened, the ventral pteropleurite slightly darkened. Halteres elongate, infuscated, base of stem narrowly yellowish white. Legs with coxæ pale, the fore and hind pairs with brown spots on outer face, the mid-coxæ ringed apically with darker brown and with its anterior aspect paler brown; trochanters testaceous yellow; femora light brown on more than the proximal half, deepening to black before the abruptly whitened tips, the latter including slightly more than the distal tenth of segment; tibiæ with base abruptly whitened, in amount subequal to the

femoral tips, followed by a black ring; legs detached but mostly preserved, and on none of them does the black ring extend beyond mid-length of segment, approximately equal on all legs and includes nearly one-third the total length of tibia; remainder of tibiae and all tarsi yellowish white, claws with the tooth obtuse. Wings long and narrow, more so than in *basilica*, almost uniformly fulvous brown, the prearcular and costal fields a trifle darker; stigma deeper brown with a still darker border; *Cu* and the veins at the wing tip bordered by brown, the latter more intensely so; small yellow spots at ends of cells R_5 and M_1 ; no pale spots before or beyond stigma; veins brown. Venation: *Rs* oblique at origin, *r-m* short but present: *m-cu* immediately beyond the fork of *M*.

Abdominal tergites chiefly dark brown, paler on lateral borders and on the basal rings of the outer segments; sternites yellow, with clearly defined brownish black median dashes, these narrow, particularly on outer segments, narrowed to long points behind and not reaching either margin; subterminal segment dark brown; hypopygium chiefly yellow, the proximal portions of basistyles and a median area on tergite slightly darkened. Male hypopygium with the posterior border of tergite with a very broad and shallow U-shaped notch, the lateral lobes thus formed narrowly obtuse, with abundant setulae; major setae pale and relatively sparse and inconspicuous, restricted to the lateral fourth of tergite. Dististyle with the spine darkened, stout, narrowly obtuse at tip; style gradually narrowed outwardly, its apex obtuse, before tip with a few inconspicuous setae.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, Abitagua, altitude 1800 metres, January 19, 1940 (*Laddey*). *Paratopotypes*, 3 ♂♂.

This is the largest species of the genus so far discovered. Among the described species in Tropical America it is perhaps most similar to *Brachypremna basilica* Alexander, of Amazonian Peru, yet is entirely distinct. It should be emphasized that the relatively broad black tibial rings are of approximately equal width on all legs, not as in *basilica* but somewhat as in the otherwise entirely different *B. pictipes* Osten Sacken, of south-eastern Brazil.

Brachypremna appendigera, sp. n.

Size above medium (wing, male, 22.5 mm.); mesonotum chiefly dark brown, the præscutum with reddish-brown interspaces; tip of terminal segment of palpus orange; antennal flagellum uniformly black; legs with genua broadly pale; tibiae with black subbasal rings, unequal on the various legs, on the posterior pair the pale tips about twice the black ring, wings with the dark and yellow pattern restricted; intermediate abdominal sternites conspicuously patterned with three black areas, the central one widened behind and reaching the posterior border, male hypopygium with the apex of dististyle expanded into an obtuse blade that bears a dark spinous flange or appendage on its face.

Male. --Length about 16 mm., wing 22.5 mm.

Frontal prolongation of head yellow above, including the clear yellow nasus which is tipped with long golden setæ; ventral half of prolongation dark brown; palpus with basal segment restrictedly darkened at proximal end, the outer half or more yellow, segments two and three chiefly yellow, weakly darkened on outer face, terminal segment black, the extreme tip abruptly orange. Antennæ with scape very weakly infuscated, constricted beneath; pedicel light yellow; flagellum uniformly black. Head with the anterior vertex brownish grey, the posterior vertex dark brown on either side of an elongate yellow pollinose median area.

Pronotum concealed in the unique type. Mesonotal præscutum with the restricted ground deep reddish brown, chiefly obliterated by dark brown stripes, lateral borders yellowish grey; remainder of mesonotum almost uniformly dark brown, the extreme lateral border of scutellum with a tiny yellow line; mediotergite not at all striped, paler and grey pruinose on the precipitous posterior portion; pleurotergite chiefly testaceous brown, the ventral portion of katapleurotergite with a blackened spot. Pleura obscure yellow, heavily patterned with dark brown on the propleura and mesepisternum; pteropleurite and meron more restrictedly marked with darker. Halteres with stem brownish yellow, narrowly clearer yellow at base, knob dark brown. Legs with the coxæ yellow, variegated with dark brown on outer faces; tro-

chanters clear yellow; femora brown, deepening to black before the relatively broad, light yellow tips; tibial bases slightly less extensively light yellow, followed by a broad black ring, the tips yellow, unequally so on the various legs; fore tibiae with about the distal tenth pale, posterior tibiae with the outer three-fifths pale, this nearly twice as extensive as the blackened ring; tarsi yellowish white. Wings with the cephalic prearcular field and the costal border darker brown than the generally infuscated ground; stigma dark brown, its centre conspicuously pale, vein *Cu* extensively bordered with brown in cell *M*; veins beyond cord bordered by brown, deepest at wing-tip; pale areas in cells *R*₃, *R*₅ and *M*₁ diffuse and relatively inconspicuous, particularly the last; cell *R*₂ with the costal border uniformly but weakly infuscated; veins brown. Venation: *R*_s relatively long, about twice the basal section of *M*₁₊₂, square at origin.

Abdomen with tergites almost uniformly infuscated except for the more yellowed basal rings; sternites conspicuously patterned with dark brown, between the second and eighth segments, each with three clearly defined brownish-black marks, the median one widened behind and reaching the posterior border, thus appearing as an elongate triangle; areas of the lateral margins long-oval in outline, not reaching either the cephalic or posterior borders; second sternite more abundantly patterned; eighth segment, excepting the yellow caudal border of the sternite and the basal portion of the tergite, dark brown; hypopygium chiefly yellow, the proximal third of basistyle infuscated. Male hypopygium with the caudal margin of tergite with a broad U-shaped emargination, the narrower lateral lobes slightly infuscated, provided with abundant setulae to their very tips. Dististyle with the outer spine relatively small and weak, dark-coloured, digitiform; lower lobe or style similarly dark-coloured; outer portion of style constricted before the obtuse apex, on face of outer blade bearing a dark flattened spinous flange that is gradually narrowed to the subacute tip.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, Rio Jatun Yacu, altitude 700 metres, April 1937 (*Macintyre*).

The present fly is most similar to *Brachypremna basilica* Alexander, differing especially in the narrower wings,

coloration of the antennæ, pattern of the abdominal sternites, and the structure of the male hypopygium, particularly the very peculiar dististyle.

Limonia (Dicranomyia) chimborazicola, sp. n.

Size large (wing, male, over 10 mm.); general coloration of mesonotum opaque brown, more or less pruinose; thoracic pleura with a faintly indicated darkened dorsal stripe; halteres elongate, blackened; legs yellow; wings narrow, pale yellow, restrictedly patterned with pale brown, including a conspicuous seam in cell *M* adjoining vein *Cu*; *m-cu* before fork of *M*; male hypopygium with the rostral prolongation short and stout, the spines unequal, the longer one placed at the summit of the produced outer margin, the second spine beneath or even slightly more distad.

Male.—Length about 9 mm.; wing 10.5×2.1 mm.

Female.—Length about 10 mm.; wing 12.3×2.8 mm.

Rostrum and palpi black, the former relatively long and more or less pendant, about one-third to one-half the remainder of head. Antennæ with scape yellow, pedicel pale brown, flagellum black; flagellar segments oval to slightly elongate-oval, the verticils somewhat shorter than the segments; in male, the outer two segments more or less fused together. Head grey, slightly more infuscated on either side of the posterior vertex; anterior vertex (male) a little less than twice the diameter of the scape.

Pronotum dark brown above, obscure brownish yellow on sides. Mesonotum opaque, the præscutum almost covered by three brown stripes, the surface heavily pruinose, especially on the sides; humeral region more yellowed; posterior sclerites of notum dark brown, pruinose; scutellum obscure reddish on posterior border, more or less divided by a pale central line. Pleura reddish brown, with a slightly darker brown dorsal stripe. Halteres long and slender, blackened, the base of stem narrowly yellow. Legs with coxæ and trochanters yellowish testaceous, the fore coxæ somewhat darkened basally; remainder of legs yellow, the outer three tarsal segments dark brown. Wings narrow, especially in the male, as shown by the measurements; ground-colour pale yellow, restrictedly patterned with pale brown, as follows:—Origin of *Rs*; both ends of the otherwise yellow stigma.

cord and outer end of cell 1st M_2 ; a broad conspicuous seam along vein Cu , mostly in cell M ; axillary portion of cell 2nd A ; veins brownish yellow, clearer yellow in the prearcular and costal fields, slightly more infuscated in the darkened portions. Venation: Sc_1 ending about opposite origin of R_s , Sc_2 a distance from its tip from one-third to one-half R_s ; basal section of R_{4+5} nearly three-fourths R_s and about in oblique alignment with it; cell 1st M_2 elongate, exceeding any of the veins beyond it; $m\ cu$ from one-third to one-fourth its own length before the fork of M .

Abdominal tergites of male weakly bicoloured, dark brown, the basal ring broadly yellowed, the apex of each segment more narrowly so; sternites less distinctly patterned, pale brown, the incisures yellow. Hypopygium with the tergite and basistyle infuscated, the ventral dististyle pale, in female, abdominal tergites more uniformly dark brown, sternites yellowish brown. Male hypopygium with the ninth tergite relatively narrow, the sides at base nearly parallel; caudal margin with a broad V-shaped notch, the lobes obtusely rounded. Basistyle with the ventromesal lobe obtusely rounded. Dorsal dististyle a strongly curved sickle, the tip obtuse. Ventral dististyle large and fleshy, its area about two and one-half times that of the basistyle, rostral prolongation short and stout, about equal in length to the longest spine, the latter placed on the summit of the produced outer margin of the prolongation; inner spine placed beneath or even slightly more distad, its length about two-thirds to three-fourths that of the major spine; apex of prolongation beyond the spines more or less produced, with a conspicuous fringe of setae. Gonapophysis with mesal-apical lobe small and slender, pale, curved to the acute tip. In *anax*, the notch of the tergite is deeper, the lobes longer and more conspicuous; rostral prolongation obtusely rounded at tip, the two spines elongate, the longest exceeding the prolongation in length, the slightly shorter second spine placed more basad than the first one.

Hab. Ecuador (Chimborazo).

Holotype, ♂, Southern slopes of Mount Chimborazo, altitude 4000 metres, May 12, 1939 (*Brown*). *Allotopotype*, ♀, May 9, 1939.

Although it is closely allied to the Peruvian *Limonia* (*Dicranomyia*) *anax* Alexander, I must consider the present

tly to be distinct, differing particularly in the details of structure of the male hypopygium, as discussed above.

Limonia (Dicranomyia) peralta, sp. n.

General coloration grey, the præscutum with three brown stripes, the lateral pair narrow and less distinct; antennæ black throughout. halteres elongate; legs light brown, the outer segments passing into black; wings relatively long and narrow, whitish subhyaline, stigma lacking; male hypopygium with the ventromesal lobe of basistyle simple; apex of dorsal dististyle narrowly obtuse, rostral prolongation of ventral dististyle small, short-cylindrical, the two spines placed at its apex.

Male.--Length about 7.5-8 mm.; wing 8.5-9 mm.

Female.--Length about 7.5-8.5 mm.; wing 9-9.5 mm.

Rostrum pendant, blackened, grey pruinose; palpi black. Antennæ black throughout; flagellar segments oval. Head clear light grey; anterior vertex (male) relatively narrow, about one-half wider than the diameter of scape.

Pronotum grey, more infuscated medially above. Mesonotal præscutum grey, clearer grey on sides, the disk with three brown stripes, the median one broad and distinct in front, becoming obsolete before the suture, lateral stripes much less distinct, scutal lobes grey, median region of scutum and the scutellum obscure yellow, sparsely pruinose; postnotum light grey. Pleura blackened, grey pruinose; dorsopleural membrane obscure yellow. Halteres elongate, stem brown, clear yellow basally, the knob dark brown. Legs with the coxæ brownish yellow; trochanters obscure yellow; femora and tibiæ light brown, the outer tarsal segments passing into black. Wings relatively long and narrow, whitish subhyaline, a little clearer yellow at base; stigma lacking or barely indicated; veins brown, more yellowed at wing base. Venation: Sc_1 ending opposite or immediately before origin of Rs , Sc_2 a short distance from its tip, Sc_1 alone nearly one-third Rs ; free tip of Sc_2 and R_2 in alignment, the former short; cell 1st M_2 elongate, subequal to vein M_{1+2} beyond it; $m\ cu$ before fork of M , in cases up to one-third its length.

Abdomen brownish black, sparsely pruinose; hypopygium more or less brightened. Ovipositor with cerci unusually slender, nearly straight, the tips acute. Male

hypopygium with the caudal border of tergite with a broad V-shaped notch, the lateral lobes broadly obtuse, their margins provided with long pale setæ. Basistyle darkened on outer face, the simple ventromesal lobe yellow. Dorsal dististyle strongly curved at outer end, the tip narrowly obtuse. Ventral dististyle large and fleshy, chiefly brownish yellow; rostral prolongation a small short-cylindrical lobe with the two spines at or close to the tip, directed outwardly. Gonapophysis with mesal-apical lobe small, curved laterad.

Hab. Ecuador (Bolívar-Chimborazo).

Holotype, ♂, Cumbres de Tililac, Chimborazo, altitude 4200 metres, April 21, 1939 (*Brown*); Alexander collection. *Allotopotype*, ♀. *Paratopotypes*, 6 ♂♀; part in American Museum of Natural History.

This fly is readily distinguished from the approximately similar regional species by the structure of the male hypopygium, especially the rostral prolongation of the ventral dististyle. In this character, the species somewhat resembles various forms that are allied to *Limonia* (*Dicranomyia*) *humidicola* (Osten Sacken), but from the elongate halteres, coloration and general appearance, it would seem that this resemblance is superficial only.

Limonia (*Dicranomyia*) *dorsolobata*, sp. n.

General coloration grey, the mesonotal præscutum with four darker brown stripes; antennæ blackened; wings with a weak brownish tinge, stigma pale brown; Sc_1 ending opposite origin of R_s , Sc_2 far from its tip, Sc_1 alone a little shorter than R_s ; basistyle of male hypopygium with a long conspicuous ventromesal lobe and a more slender dorsomesal one; ventral dististyle with two elongate fleshy lobes placed close to the base of the rostral prolongation.

Male.—Length about 6.5–7 mm.; wing 7.5–8 mm.

Rostrum dark brown, grey pruinose; palpi black. Antennæ with scape and pedicel brownish black, flagellum black; flagellar segments oval; longest verticils a trifle exceeding the segments; terminal segment about one-third longer than the penultimate. Head light grey; anterior vertex relatively wide, nearly four times the diameter of the scape.

Pronotum grey, lined with brown, especially medially behind. Mesonotal præscutum grey laterally, the disk more infuscated, with four darker brown stripes that are more or less confluent; scutum chiefly dark; scutellum brown, heavily grey pruinose; postnotum grey. Pleura grey, the pteropleurite and meral region with the underlying ground somewhat paler. Halteres relatively short, stem yellow, knob infuscated. Legs with the coxæ and trochanters brownish yellow or obscure yellow; remainder of legs brownish black, the tarsi passing into black. Wings with a weak brownish tinge, the stigma pale brown, only a little darker than the ground; veins brown. Venation: Sc_1 ending opposite origin of R_s , Sc_2 far from its tip so Sc_1 alone is only a little shorter than R_s ; free tip of Sc_2 short, in approximate transverse alignment with R_2 ; $m-cu$ just before the fork of M .

Abdominal tergites dark brown, the basal sternites a little paler; hypopygium dark chestnut-brown. Male hypopygium with the tergite transverse, its posterior border very gently emarginate, the lobes very low, with abundant erect setæ. Basistyle with a long curved ventromesal lobe close to its base, the lower portions with very long setæ; a second more dorsal slender lobe on the extreme apical mesal angle, this provided with scattered setæ. Dorsal dististyle strongly curved to the acute tip. Ventral dististyle fleshy, its total area subequal to that of the basistyle; rostral prolongation slender on outer portion, with two long slender spines that are a little shorter than the lobe and more or less interconnected with one another by a narrow sclerotized base; two conspicuous fleshy lobes on mesal face of style near base of prolongation, with a third low setiferous cushion still closer to the proximal portion, this last with unusually long setæ. Gonapophyses with mesal-apical lobes short, slender curved to the acute tips.

Hab. Ecuador (Chimborazo, Tungurahua).

Holotype, ♂, Riobamba, Chimborazo, altitude 2700 metres, April 19, 1939 (*Brown*). *Paratypes*, 2 ♂♂, Baños, Tungurahua, altitude 1450 metres, April 23, 1939 (*Macintyre*); 1 ♂, El Salado, Baños, altitude 1900 metres, August 13, 1937 (*Macintyre*).

The present fly is readily distinguished by the peculiar structure of the male hypopygium, especially the arma-

ture of the basistyle and ventral dististyle. The most similar species are *Limonia* (*Dicranomyia*) *bicomifera* Alexander and *L. (D.) quadrituberculata* Alexander, but the resemblance is not particularly close.

Limonia (Rhipidia) sybarita, sp. n.

Allied to *pallatangæ*; size relatively large (wing, male, 9.5 mm.); general coloration of mesonotum reddish brown to dark brown, pruinose; antennæ (male) short-unipectinate, blackened, including the apical pedicels of the segments; longest branch a trifle less than the segment itself; knob of halteres dark brown; femora black, only their bases narrowly yellow, wings with a strong blackish tinge, very restrictedly patterned with darker clouds; stigma paler than the ground, encircled by pale brown; *Sc*₁ ending about opposite two-fifths the length of *Rs*; a cross-vein in cell *M*₁, *m-cu* more than one-half its length before the fork of *M*; male hypopygium with the rostral spines short, slightly separated at their bases, gonapophysis with tip of mesal apical lobe narrowed into a blackened spinous point.

Male.—Length about 7.5 mm., wing 9.5 mm.; antenna about 1.9 mm.

Rostrum black, relatively long, about two-thirds the remainder of head; palpi black. Antennæ with scape brownish black; remainder of antennæ black, including the stems or pedicels of the flagellar segments; flagellar segments short-unipectinate, the longest branches a little shorter than the segment itself; terminal segment about one-fourth longer than the penultimate. Head grey, posterior vertex with a small blackened triangle; anterior vertex relatively narrow, less than the diameter of scape.

Pronotum brown, blackened medially and on sides. Mesonotal præscutum unusually flattened, reddish brown, more infuscated on cephalic portion, the surface, especially of the sides, grey pruinose, scutum greyish testaceous, the lobes conspicuously patterned with brown; scutellum brown, postnotum still darker brown. Pleura and pleurotergite light grey, conspicuously striped longitudinally with black, the more dorsal stripe broader, passing beneath the root of the halteres to the abdomen; ventral stripe at near mid-height of the sternopleurite. Halteres with

stem yellow, knob dark brown. Legs with the coxæ pale, the basal portions narrowly infuscated; trochanters yellow; femora black, the bases narrowly yellow; tibiae light brown, the tips narrowly brownish black; basitarsi obscure yellow, the tips darker; outer tarsal segments black. Wings narrow, with a strong blackish tinge, very restrictedly patterned with darker clouds, especially at wing-base, along vein *Cu* in cell *M*, along cord and outer end of cell 1st *M*₂; stigma paler than the ground, encircled by pale brown; outer ends of cells at and near-wing-tip slightly brightened. veins brown. Venation: *Sc* relatively long, *Sc*₁ ending about opposite two-fifths the length of *Rs*, *Sc*₂ close to its extreme tip; *Rs* about one-half longer than *R*₂₊₃; cell 1st *M*₂ rectangular, about as long as vein *M*₃ beyond it; a supernumerary or adventitious cross-vein in cell 2nd *M*₂; *m-cu* more than one-half its length beyond the fork of *M*. In one wing of type, cell *M*₁ has a second adventitious vein.

Abdominal tergites dark reddish brown, the caudal borders more darkened; outer segments, including hypopygium, more uniformly dark brown; basal sternites more brightened. Male hypopygium with the ninth tergite narrowly transverse. Basistyle small, the ventromesal lobe occupying all of its mesal face, with a second low lobule on its face near base. Dorsal dististyle relatively slender, strongly curved, the tip suddenly acute. Ventral dististyle fleshy, its area about twice that of the basistyle; rostral prolongation moderately long, the two spines short, separated from one another by a distance equal to about one-third to one-fourth their own length. Gonapophysis with mesal-apical lobe darkened, at apex suddenly narrowed into a blackened spinous point.

Hab. Ecuador (Bolívar).

Holotype, ♂, Hacienda Talahua, altitude 3100 metres, May 7, 1939 (*Brown*).

The present fly is entirely distinct from the various other regional species that have the male antennæ unipectinate. The nearest relatives are *Limonia* (*Rhipidia*) *pallatangæ* (Alexander) and *L. (R.) thysbe* Alexander, but the similarity is not close. If the cross-vein in cell *M*₁ of the wings proves to be a supernumerary rather than an adventitious element, it will provide a unique character for the separation of the species.

Limonia (Rhipidia) sycophanta, sp. n.

Allied to *pallatangæ*; general coloration of mesonotum dark brown, more or less pruinose; thoracic pleura striped longitudinally with black; antennæ long-unipectinate in male, short-unipectinate to serrate in female; flagellum bicolored, the bases and branches black, the apical stems abruptly pale, femora yellow, with a nearly terminal black ring; wings whitish subhyaline, conspicuously patterned with brown subcostal areas and paler brownish grey clouds over most of wing; pale subcostal interspaces more extensive than the darkenings; *Sc*₁ ending nearly opposite mid-length of *Rs*; *m-cu* some distance before fork of *M*; abdominal segments bicoloured, reddish brown, their posterior borders darker brown; male hypopygium with the dorsal dististyle unusually stout; ventral dististyle small, rostral spines short; mesal-apical lobe of gonapophysis blackened, terminating in a stout curved hook.

Male.—Length about 7.5 mm.; wing 8.5 mm.; antenna about 1.7 mm.

Female.—Length about 8–8.5 mm.; wing 9.5–10 mm.

Rostrum black, relatively long, nearly equal in length to remainder of head; palpi black. Antennæ black, the apical stems of the flagellar segments conspicuously pale; in male, segments relatively long-unipectinate, the longest branches about one-fourth longer than the segment; simple terminal segment suddenly narrowed on the distal third or less; in female, the pectinations are shorter, the longest approximately two-thirds the segment. Head brownish grey, the central portion of the posterior vertex still darker; anterior vertex (male) very narrow, approximately one-half the diameter of scape; in female broader, slightly exceeding the diameter of scape.

Pronotum yellowish grey pollinose over a brown ground. Mesonotal præscutum and scutal lobes chiefly dark brown, the sides of the former more reddened and pruinose; scutellum darkened at base, its apex broadly testaceous yellow; postnotum dark brown, grey pruinose. Pleura and pleurotergite dark grey, with longitudinal black stripes, the more conspicuous being dorsal in position, extending from the propleura across the dorsal mesopleura and ventral pleurotergite to the base of abdomen, passing beneath the wing-root. Halteres with stem obscure

yellow, the knob more infuscated, in male with the apex slightly yellowed. Legs with the coxæ dark brown, sparsely pruinose; trochanters obscure yellow; femora yellow, with a black, nearly terminal ring; tibiæ brownish yellow, the tips narrowly blackened; tarsi with proximal three segments light brown, their tips darkened; outer tarsal segments uniformly blackened. Wings whitish subhyaline, with a relatively heavy pale brownish-grey pattern, together with four darker brown subcostal areas that do not reach the costal border; pale subcostal interspaces subequal to or more extensive than the darkenings; stigma of male almost uniformly infuscated, the extreme centre paler; in female, stigma more extensively yellow, ringed with darker; the most conspicuous dark clouds occur at origin of *Rs*, cord, outer end of cell 1st M_2 and as a seam in cell *M* adjoining vein *Cu*; darkened clouds at ends of veins R_3 and the anals, much less evident on the other veins; veins brownish yellow, darker in the clouded portions. Venation *Sc* relatively long, Sc_1 ending about opposite two-fifths to one-half the length of the long *Rs*, Sc_2 a short distance from its tip; *m-cu* variable in position, from more than one-half to almost its own length before the fork of *M*.

Abdomen indistinctly bicoloured, reddish brown, the posterior borders of the segments broadly dark brown. Male hypopygium with the tergite transverse, strongly narrowed outwardly, the margin very shallowly notched, the lobes correspondingly small and low. Basistyle with ventromesal lobe blackened, stout, simple. Dorsal dististyle unusually stout, gently curved, the tip a long spine. Ventral dististyle fleshy, small, its total area not exceeding one and one-half times that of the basistyle; prolongation slender, its tip obliquely truncated, provided with about three setæ; rostral spines placed on side of prolongation, short, less than the length of the prolongation beyond the outer spine. Gonapophysis with mesal-apical lobe elongate, blackened, terminating in a stout curved hook. Apical lobes of ædeagus unusually small.

Hab. Ecuador (Bolivar).

Holotype, ♂, Hacienda Talahua, altitude 3100 metres, May 7, 1939 (Brown). *Allotopotype*, ♀, with the type. *Paratopotypes*, 2 ♀♀, altitude 2900–3100 metres, April 30–May 5, 1939 (Brown).

The most similar regional species are *Limonia* (*Rhipidia*) *pallatangæ* Alexander, *L. (R.) sybarita*, sp. n., and *L. (R.) thyse* Alexander, particularly the first named. These flies differ in the coloration of the legs and wings, and in the structure of the male hypopygium, especially the tergite, dorsal dististyle and gonapophyses.

Limonia (*Geranomyia*) *pallidapex*, sp. n.

Size small (wing, male, 5.5 mm.); rostrum black except at base, exceeding two-thirds the length of body; head, mesonotum and dorsal thoracic pleura black, the ventral pleurites abruptly yellow; legs with posterior basitarsi dilated; wings strongly infuscated, the costal fourth abruptly whitened, the colour extending around the wing-tip into cell 2nd M_2 ; Sc short, Sc_1 ending just beyond origin of R_s ; abdominal tergites dark brown, the posterior borders narrowly black; outer segments and hypopygium black; male hypopygium with the rostral spines arising from small inconspicuous tubercles.

Male.—Length, excluding rostrum, about 5.5 mm.; wing 5.5 mm.; rostrum about 3.9 mm.

Rostrum elongate, exceeding two-thirds the length of the body or wing, black, the base narrowly obscure yellow; palpi black. Antennæ black throughout. Head black.

Pronotum obscure yellow. Mesonotum and adjoining portions of pleura, including the dorsopleural region, anepisternum, dorsal pteropleurite and pleurotergite black, contrasting abruptly with the light yellow ventral pleurite; central portion of præscutum behind, with the adjoining portions of scutum, a little paler. Halteres infuscated. Legs with all coxæ and trochanters pale yellow; remainder of legs yellow, the femoral tips weakly infuscated; posterior basitarsi flattened, as in *lacteitarsis* and *luteimana*. Wings conspicuously bicoloured, the costal border broadly whitened, the posterior three-fourths strongly infuscated; the white costal portion variegated by three darker brown areas, including a small spot above arculus; an area over the supernumerary cross-vein in cell Sc , not involving cell C ; a third common area over the fork of Sc and origin of R_s ; fourth dark costal area stigmal; the white costal markings reach R_s behind, include all but the posterior portion of cell Sc_2 and involve the narrow wing apex in cells R_3 to 2nd M_3 , inclusive;

veins pale brown, darker in the clouded portions. Venation : *Sc* short, *Sc*₁ ending a little beyond origin of *Rs*, *Sc*₂ at its tip ; *Rs* strongly angulated to nearly square at origin ; second section of vein *R*₄₊₅ arcuated on its basal third ; cell 1st *M*₂ a little shorter than vein *M*₁₊₂ beyond it ; *m-cu* close to fork of *M*.

Abdominal tergites weakly bicoloured, dark brown, the posterior borders narrowly blackened, the pleural membrane less evidently so ; sternites more conspicuously bicoloured, yellow, the posterior margins very narrowly infuscated ; outer segments and hypopygium more uniformly darkened. Male hypopygium generally as in *luteimana*, differing in the details. Dorsal dististyle larger, extending to opposite three-fourths the width of the ventral dististyle, the latter with the spines distinctive ; larger or more basal spine from a low inconspicuous basal tubercle, the spine straight ; outer or smaller spine about two-thirds as long and more slender. In *luteimana*, both spines much longer, the larger one from a conspicuous elongate basal tubercle that is nearly one-half as long as the outer spine.

Hab. Ecuador (Santiago-Zamora).

Holotype, ♂, Zumbi, Rio Zamora, altitude 700 metres, November 1, 1941 (*Laddey*).

The most similar known species are *Limonia* (*Geranomyia*) *lacteitarsis* (Alexander) and *L. (G.) luteimana* Alexander, both of which have the same dilated posterior basitarsi and unusually elongate rostrum. These species differ in the larger size and in the details of coloration of the body, antennæ, halteres and wings. The structure of the male hypopygium of *lacteitarsis* is still not known to me ; that of *luteimana* has been discussed and compared above.

Limonia (Geranomyia) opulens, sp. n.

Size large (wing, male, 9 mm.) ; general coloration of mesonotum grey, the præscutum with three intermediate black stripes ; knobs of halteres infuscated ; fore coxæ darkened ; wings yellow, with a conspicuous brown pattern, including a common area over the fork of *Sc* and origin of *Rs* ; a yellow band in outer radial field before the uniformly darkened wing-tip ; vein *Sc*₁ ending about opposite one-fifth the length of *Rs* ; cell 1st *M*₂ a little

longer than vein M_{1+2} beyond it; male hypopygium with the caudal margin of the ninth tergite having a deep V-shaped notch; dorsal dististyle slender; rostral prolongation of ventral dististyle widened outwardly, its tip obtuse; rostral spines from a conspicuous common tubercle; mesal-apical lobe of gonapophysis long and slender, pale throughout.

Male.—Length, excluding rostrum, about 8 mm.; wing 9 mm.; rostrum about 5.1 mm.

Rostrum elongate, exceeding one-half the length of wing, black throughout; palpi black. Antennæ black throughout; flagellar segments oval; terminal segment elongate, about one-third longer than the penultimate. Head with a narrow central light grey line extending from the anterior vertex to the centre of the posterior vertex, on the latter subtended on either side by a more blackened area.

Pronotum grey, trivittate with brownish black, the central area wider. Mesonotal præscutum grey, with three narrow black stripes that are subequal in width to the ground interspaces; humeral region and lateral borders grey; the sublateral portions more reddened; scutum grey, clearer medially, the mesal portion of each lobe black, this being a direct posterior prolongation of the sublateral præscutal stripe; scutellum dark basally, more reddened along posterior border; postnotum brown, grey pruinose. Pleura darker grey above, more reddish brown, grey pruinose, on the sternopleurite, particularly its dorsal portion. Halteres with stem yellow, knob infuscated. Legs with the coxæ and trochanters yellow, the fore coxæ weakly infuscated; remainder of legs broken. Wings with the ground colour creamy yellow, the prearcular and costal fields more saturated yellow; a heavy brown pattern, as follows:—at and above the arculus, the latter chiefly in cell *Sc*; over the supernumerary cross-vein in cell *Sc*, including cell *C* and almost crossing *R*; a common area over the fork of *Sc* and origin of *Rs*; stigma; wing tip broadly and continuously darkened, variegated by yellow near the bases of the outer medial cells; a broad yellow band before wing apex, extending from costa obliquely into cell 1st M_2 ; brown seams along cord and outer end of cell 1st M_2 ; large marginal spots at ends of anal veins; veins yellow, brown in the patterned fields. Vena-

tion: Sc_1 ending about opposite one-fifth the length of Rs , Sc_2 not far from its tip; cell 1st M_2 large, a little longer than vein M_{1+2} beyond it, $m-cu$ shortly beyond fork of M .

Abdomen dark reddish brown; hypopygium more brownish yellow. Male hypopygium with the tergite large, narrowed outwardly, its caudal margin with a deep and narrow V-shaped notch, the thickened lobes conspicuous, provided with coarse setæ. Basistyle small, its total area only about one-third that of the ventral dististyle; ventromesal lobe large, simple; body of style with relatively few setæ. Dorsal dististyle slender, curved, the tip narrowed into a long black spine. Ventral dististyle fleshy; rostral prolongation slightly widened outwardly, the tip obtuse; spines arising from summit of a conspicuous common tubercle, nearly equal to one another in length, the outer spine placed a little lower on the tubercle. Gonapophysis with mesal-apical lobe pale, long and slender, gently sinuous, the apex narrowly obtuse.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Baños, altitude 1900 metres, April 29, 1939 (*Macintyre*).

The present fly is most similar in its general appearance to *Limonia* (*Geranomyia*) *destricta* Alexander, which differs especially in the structure of the male hypopygium, particularly the transverse, shallowly emarginate tergite, the distinctive rostral prolongation and spines, broader dorsal dististyle, and the even narrower, more pointed lobes of the gonapophyses.

Limonia (*Geranomyia*) *parilis*, sp. n.

Size large (wing, male, 10 mm.); rostrum approximately one-half the length of wing; general coloration of mesonotum dark plumbeous grey, the præscutum with two conspicuous black stripes, the usual median one much fainter; humeral angles of præscutum abruptly buffy yellow; wings whitish subhyaline, heavily patterned with brown, the cells at wing-tip variegated with pale; Sc_1 opposite mid-length of Rs ; cell 1st M_2 long, exceeding vein M_{1+2} beyond it; male hypopygium with the ninth tergite narrowly transverse, its caudal margin very broadly and shallowly notched, the lobes low; rostral spines from a large common basal tubercle, but each from its own

individual elevation; gonapophysis with mesal-apical lobe darkened, the tip very obtuse.

Male.—Length, excluding rostrum, about 10 mm.; wing 10 mm.; rostrum about 5 mm.

Rostrum black, elongate, approximately one-half as long as the wing or remainder of body; palpi black. Antennæ black throughout; flagellar segments oval, with truncated ends; verticils of outer segments very small. Head with anterior vertex buffy grey, the colour extending backward onto the posterior vertex for a short distance; the vertex immediately behind the antennal bases and most of the posterior portion of head uniformly dark plumbeous grey; occipital region more reddened.

Cervical conspicuously elongate, brownish black. Pronotum buffy medially, more pruinose on sides, with a narrow brown median vitta. Mesonotal præscutum chiefly dark plumbeous grey, the usual interspaces with a narrow, almost entire black stripe, the usual median blackened vitta much fainter to scarcely indicated against the ground; humeral triangle conspicuous, abruptly buffy yellow; scutal lobes dark grey, more or less variegated with blackish on the lateral and mesal borders, the central region of scutum light grey; scutellum darkened at base, its caudal border broadly reddened; postnotum grey, somewhat more blackish grey on the posterior portion. Pleura grey, variegated with darker grey to produce vague incomplete stripes; dorsopleural membrane pale yellow. Halteres with stem yellow, knob brownish black. Legs with the coxæ reddish yellow, the fore and middle pairs slightly more infuscated; trochanters obscure yellow; remainder of legs broken. Wings with the ground-colour whitish subhyaline, heavily patterned with brown, including four somewhat darker subcostal areas that are more extensive than the yellowish white interspaces; the paler brown pattern is arranged much as in *laudanda*, appearing as extensive areas in all cells, subequal in extent to the ground interspaces, distributed as follows:—subcostal dark areas extended caudad into cell *R*; stigma confluent with broad seams along cord, extended caudad into cell *R*₂, isolating a pale spot at base of cell *R*₃; outer end of cell 1st *M*₂ and very extensive marginal clouds in the cubital and anal fields; wing-tip variegated with pale spots in all cells; veins

yellow in the ground, more infuscated in the clouded portions. Venation: *Sc* relatively long, *Sc*₁ ending about opposite mid-length *Rs*, *Sc*₂ at its tip; *Rs* long, about three times the basal section of *R*₄₊₅; cell 1st *M*₂ elongate, exceeding vein *M*₁₊₂ beyond it; *m-cu* at fork of *M*; cell 2nd *A* wide.

Abdomen with basal tergite light fulvous yellow, remaining tergites dark brown, sparsely pruinose; sternites more obscure yellow; hypopygium brownish yellow. Male hypopygium with the ninth tergite narrowly transverse, its caudal margin very broadly and shallowly notched, the lateral lobes correspondingly low and only slightly thickened. Basistyle with its total area about one-third that of the large fleshy ventral dististyle; ventromesal lobe relatively small, more or less constricted at base. Dorsal dististyle relatively slender, gradually narrowed, tapering very gradually into a long apical spine. Ventral dististyle with the rostral prolongation small, the apex obtusely rounded; spines subequal, slender, from a common tubercle at base of prolongation, but each spine from its own individual, much smaller tuberculate swelling. Gonapophysis with mesal-apical lobe darkened, curved, the tip very obtuse; lateral margin of each lobe extended into a low flange.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Runtun, above Baños, altitude 2200 metres, July 21, 1939 (*Macintyre*).

Limonia (*Geranomyia*) *parilis* is allied to *L. (G.) dstricta* Alexander, *L. (G.) laudanda* Alexander, and other large and showy species. It has a wing-pattern much as in *laudanda*, but the structure of the male hypopygium is quite different from the latter and from other generally similar species.

Polymera (Polymera) nimbipennis, sp. n.

Mesonotum medium brown, unpatterned; thoracic pleura with a relatively broad black dorsal stripe, the ventral pleurites abruptly yellow; antennal flagellum brownish black, the segments binodose; legs black, the outer tarsal segments white, on the hind legs including all of the tarsi excepting the last segment; all coxæ yellow; tips of femora and tibiæ blackened; wings with a very strong brownish suffusion; *Sc* short, *Sc*₁ ending

opposite or before two-fifths the length of R_{2+3+4} ; R_{1+2} subequal to R_{2+3} ; $m-cu$ nearly its own length beyond the fork of M .

Male.—Length about 4.5–4.6 mm.; wing 5.6–5.8 mm.; antenna about 5.9–6 mm.

Rostrum yellow; basal segments of palpus yellow, the outer ones pale brown. Antennæ (male) slightly longer than the wing; brownish black, the scape and pedicel a trifle brighter, particularly the latter; flagellar segments strongly binodose, both swellings subequal; verticils very long and conspicuous, about equal in length on both swellings. Head brown.

Pronotum concealed in the type. Mesonotum almost uniformly medium brown, without pattern, the scutellum and postnotum sparsely pruinose. Pleura with a relatively broad black dorsal stripe, the sternopleurite and meron abruptly yellow. Halteres infuscated, especially the knob, the base of stem very restrictedly brightened. Legs with all coxæ and trochanters yellow; femora brownish black, the bases narrowly more yellow; tibiæ almost uniformly brownish black, the tips more blackened; fore basitarsi black, the tips very narrowly whitened; remainder of fore tarsi and all of middle legs broken; hind tarsi snowy white, only the terminal segment brownish black. Wings with a very strong dark brown suffusion, the prearcular and proximal costal fields slightly more yellow; veins and macrotrichia darker brown. Venation: Sc short, Sc_1 ending about opposite or before two-fifths R_{2+3+4} , Sc_2 near its tip; Rs about one-sixth longer than R_{2+3+4} , the latter about three-fourths R_{2+3} ; R_{1+2} subequal to R_{2+3} ; $m-cu$ nearly its own length beyond the fork of M . In the paratype R_{1+2} is shorter, only about one-half R_{2+3} .

Abdomen piceous, more blackened laterally; subterminal segments more uniformly blackened; hypopygium dark chestnut-brown.

Hab. Ecuador (Santiago-Zamora).

Holotype, ♂, Zumbi, Rio Zamora, altitude 700 metres, November 2, 1941 (*Laddey*). *Paratopotype*, 1 ♂, November 5, 1941.

Polymera (Polymera) nimbipennis is most similar to *P. (P.) leucopeza* Alexander, of southern Mexico, which differs in various regards, as the longer antennæ of male

and the paler wings, with distinct venational details, including the relative proportions of the outer radial veins. Both flies have the leg pattern much the same.

Limnophila spinulosa, sp. n.

Allied to *lloydi*; general coloration of thorax brownish grey, with a restricted dark brown pattern, including paired spots on the præscutum on either side of the median line before the suture; halteres uniformly pale yellow; legs yellow, the segments, especially the femora, with conspicuous erect spinose setæ; wings whitish subhyaline, with a dark brown reticulated pattern, the transverse darkenings more or less expanded at either end to produce a dumb-bell shaped figure, R_{2+3+4} long, about one-third the anterior branch of R_s , R_2 either lacking or very faint, subequal in length to R_{1+2} ; male hypopygium with the outer dististyle setiferous, terminating abruptly in a single slender spine; gonapophysis ending in a single spine; ædeagus short.

Male.—Length about 6.5 mm.; wing 7 mm.

Rostrum dark brown; palpi black. Antennæ short; basal segments yellow, flagellum pale brown, verticils of the flagellum exceeding the segments in length. Head grey.

Pronotum grey above, narrowly lined with darker on sides. Mesonotal præscutum brownish grey, with a restricted dark brown pattern, including a spot on either side of the mid-line immediately before the suture and less evident lateral darkenings behind the pseudosutural foveæ; a faintly indicated median præscutal stripe, slightly widened behind; scutum pale brownish grey, the lobes variegated by brown, especially behind, restricting the grey central area to a narrow marking at the base of the greyish-brown scutellum; central portion of mediotergite grey, the lateral portions and the pleurotergite dark brown. Pleura chiefly dark brown, pruinose, the central portion somewhat paler; dorsopleural region buffy. Halteres uniformly pale yellow. Legs with the coxæ and trochanters brownish yellow, the latter with a dark apical spot beneath; femora yellow; remainder of legs yellow, the terminal tarsal segment infuscated, the apices of the remaining tarsal segments narrowly darkened; legs with unusually strong erect spinous setæ on most of the segments, including a ventral series on almost the basal

half of at least the posterior femora (remaining legs broken), these setæ arranged generally in two rows and more or less equidistantly spaced. Wings whitish subhyaline, with a relatively heavy dark brown reticulated pattern that consists of narrow transverse dashes in most of the cells, *Sc* and *R* being most nearly free of markings; larger brown areas at origin of *Rs*; at stigma, extending backward as a narrower line over the cord; and a major mass in the outer radial field, chiefly in cells *R*₃ and *R*₄; the dark lines are narrow and transverse, completely crossing the cells, being more or less expanded at either end to produce a dumb-bell like effect; in outer medial field the margin is narrowly and more extensively darkened; dark areas over veins *Cu*₁ and 2nd *A* more extensive; veins yellow, darker in the patterned fields. Venation: *Sc*₁ ending about opposite two-fifths the length of *R*₂₊₃₊₄; *Sc*₂ at its tip; *Rs* elongate, weakly angulated at origin; *R*₂₊₃₊₄ unusually long for a member of this group, about one-third as long as the anterior branch of *Rs*; *R*₂ very faintly indicated or lacking, if present, evidently subequal to *R*₁₊₂; cell 1st *M*₂ elongate, gently widened outwardly, nearly as long as vein *M*₃ beyond it; *m-cu* at from two-thirds to three-fourths its length beyond the fork of *M*; cell *M*₁ subequal to its petiole; cell 2nd *A* wide, the vein sinuous; anterior arculus preserved.

Basal abdominal tergites dark brown, the intermediate segments more variegated apically with obscure yellow; sternites clearer yellow; subterminal segments more uniformly dark brown; hypopygium brownish yellow. Male hypopygium with the outer dististyle relatively broad, slightly widened outwardly, at apex suddenly narrowed into a slender, gently curved spine, the outer ventral angle, before the spine, with a shorter point; surface of style with abundant long setæ. Gonapophysis broad at base, terminating in a slender spine. Aedeagus short, broad-based, the penis slightly sinuous within the sheath.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, Abitagua altitude 1800 metres, April 15, 1940 (*Laddey*).

The most similar described species is *Limnophila lloydi* Alexander, of Colombia, which differs conspicuously in

the coloration of the body, and in the pattern and venation of the wings.

Atarba (Atarba) cucullata, sp. n.

General coloration of thorax dark reddish brown, the surface sparsely pruinose; antennæ (male) about one-half as long as body, the proximal flagellar segments weakly bicoloured, black, with both base and apex narrowly yellow; legs yellow, the outer tarsal segments weakly infuscated; wings with a faint brownish-yellow tinge; stigma small, pale brown; *m-cu* at near mid-length of lower face of cell 1st M_2 ; male hypopygium with the apical spine of the outer dististyle short; gonapophysis pale, the apex obtuse and smooth; ædeagus at apex greatly expanded into a transverse hood-shaped blade.

Male.—Length about 6 mm.; wing 5.2 mm.; antenna about 3 mm.

Head, with the exception of the antennæ, lost. Antennæ of moderate length; scape and pedicel pale brown, flagellum darker brown, the incisures of about the proximal five segments very narrowly yellow, involving both the base and the apex of the segment; basal segments long-cylindrical, the outer ones shorter, more elongate-oval; besides the basal verticils, segments provided with a dense erect shorter pubescence, each with a short subtending point to produce a scabrous appearance.

Thorax almost uniformly dark reddish brown, the surface sparsely pruinose; ventral pleurites a little more reddened. Halteres with stem pale, knob infuscated. Legs with the coxæ reddish yellow; trochanters yellow; remainder of legs yellow, the femoral tips not darkened; outer tarsal segments weakly infuscated. Wings with a faint brownish-yellow tinge, the prearcular and costal fields somewhat clearer yellow; stigma small, pale brown; veins yellow, macrotrichia dark brown. Macrotrichia on veins beyond cord abundant and conspicuous; basad of cord with trichia on distal third of first section of Cu_1 and on more than the outer half of vein 2nd A . Venation: Sc short, Sc_1 ending about opposite one-fifth the length of the short arcuated Rs , Sc_2 shortly before the origin of the latter; basal section of R_5 about two-thirds Rs ; anterior branch of the latter long and gently sinuous; cell 1st M_2 short-subpentagonal, *m-cu* at mid-length of its lower face.

Abdomen dark reddish brown, more blackened laterally: subterminal segments more uniformly blackened; hypopygium with the sternal plate not clearly evident in the unique type-slide. Outer dististyle moderately slender, the apical spine subequal to or shorter than the subterminal outer tooth; about nine or ten spines on outer margin of style, forming an irregular double row. Inner dististyle slender, about one-fourth longer than the outer style, its apex obliquely obtuse. Gonapophysis with apex obtusely rounded, entirely smooth and pale. *Ædeagus* of unusually powerful development, especially the apex which is expanded into a flaring hood-shaped structure, in the slide-mount spreading flat, its total width subequal to the full length of the basistyle.

Hub. Ecuador (Santiago-Zamora).

Holotype, ♂, Zamora, altitude 1000 metres, December 20, 1941 (*Laddey*).

The present fly is most closely related to *Atarba* (*Atarba*) *megaphallus* Alexander, of Amazonian Brazil, which has the same somewhat peculiar type of *ædeagus*. The latter species differs in the much longer, differently patterned antennæ of the male, and in the details of structure of the hypopygium, including both dististyles.

Atarba (*Atarba*) *circe*, sp. n.

General coloration light brown; antennæ (male) elongate, approximately four-fifths the length of body; proximal flagellar segments bicolored, black, the basal fifth yellow, the amount of the latter colour decreasing on outer segments; knobs of halteres infuscated; legs yellow, the femoral tips very narrowly blackened; wings with a greyish yellow tinge, stigma medium brown, relatively conspicuous; *Sc*₁ ending just beyond origin of *Rs*; cell 1st *M*₂ irregularly-pentagonal, shorter than any of the veins beyond it; abdominal tergites bicolored, yellow basally, the subapical portions brown; no distinct blackened subterminal abdominal ring; male hypopygium with the outer dististyle expanded on basal half, the long tip terminating in a conspicuous spine, with about two more appressed spines back from the tip; inner dististyle slender, strongly arcuated; gonapophysis with numerous short spinous points at tip.

Male.—Length about 5 mm.; wing 5.5 mm.; antenna about 4 mm.

Rostrum brown; palpi relatively elongate, brownish black. Antennæ (male) long, as shown by the measurements; scape and pedicel dark brown; flagellar segments black, the bases conspicuously yellow, the extreme tips similarly brightened; the amount of yellow at bases of the more proximal segments involves about one-fifth the segment, the amount decreasing on the outer segments; besides a relatively inconspicuous erect pale pubescence, each segment with a single long verticil, placed at or before mid-length of segment. Head brown

Thoracic dorsum almost uniformly light brown, very sparsely pruinose but without pattern. Pleura brownish testaceous, paler on the ventral sclerites. Halteres with stem yellow, knob infuscated. Legs with the coxæ obscure yellow; trochanters yellow; femora yellow, the tips very narrowly blackened; tibiæ and tarsi yellow, the outer segments of the latter a trifle more darkened; tibial spurs small but evident. Wings with a greyish yellow tinge, the prearcular and costal fields clear light yellow, the latter colour continued to the end of cell R_3 ; stigma medium brown, relatively conspicuous; veins brownish yellow, clearer in the luteous fields. Venation: Sc_1 ending just beyond origin of Rs , Sc_2 immediately before this origin; Rs about one-third longer than the basal section of R_5 ; cell 1st M_2 irregularly pentagonal, shorter than any of the veins beyond it; $m-cu$ about one-fourth its length beyond the fork of M .

Basal abdominal tergites medium brown, darker laterally; intermediate segments bicolored, the basal half yellow, the outer portions brown with the extreme margins again yellow; no distinct blackened subterminal ring, as is frequent in the genus; sternites more extensively yellow; segments eight and nine yellow. Male hypopygium with the outer dististyle of distinctive conformation, appearing as a slender flattened blade, at near mid-length strongly narrowed into a blackened spine, with one or two appressed spinules back from the tip; on the more expanded basal half the blackened outer margin bears about six or seven spines, the outer ones larger and becoming more erect; beyond the last of these, on the narrowed outer portion, a long space, equal to about one-third to one-fourth the total length, unprovided with denticles. Inner dististyle slender, blackened, almost parallel-sided, at mid-length bent at a strong angle. Gona-

pophysis apex with numerous short spinous points, these much shorter than in *multiarmata*. Aedeagus long, nearly straight, the tip moderately flaring and more or less hood-shaped.

Hab. Ecuador (Santiago-Zamora).

Holotype, ♂, Zamora, altitude 1000 metres, October 19, 1941 (*Laddey*).

Atarba (*Atarba*) *circe* is readily told from its nearest relatives, *A. (A.) idonea* Alexander and *A. (A.) multiarmata* Alexander, by the coloration of the body, wings and antennæ, and by the structure of the male hypopygium, especially the outer dististyle and the gonapophysis.

Gonomyia (*Lipophleps*) *arajuno*, sp. n.

Belongs to the *manca* group, allied to *haploides*; general coloration brown. the thoracic pleura brown, faintly striped with paler; legs brown; male hypopygium with the dististyle terminal, entirely fleshy, relatively large, provided with a series of from four to six strong setæ down the face and mesal margin; a single elongate rod jutting from the cup of the phallosome.

Male.—Length about 3.8 mm.; wing 4 mm.

Female.—Length about 4.5 mm.; wing 4.4 mm.

Rostrum obscure yellow; palpi black. Antennæ black; pedicel (male) enlarged. Head dark grey, lighter grey on orbits.

Pronotum and pretergites light yellow, the sides of the former darker. Mesonotal præscutum and the scutal lobes dark brown, sparsely pruinose; central region of scutum light grey; scutellum with posterior border broadly yellow, the base infuscated; postnotum brown, more yellow on the dorsal portion. Pleura dark brownish grey, with a broad yellowish grey longitudinal stripe, ill-delimited and becoming wider behind. Halteres weakly infuscated, especially the knobs. Legs with the coxæ yellow, the fore pair more infuscated; trochanters obscure yellow; remainder of legs brownish black. Wing with a weak brownish tinge, the prearcular and costal fields light yellow; stigma scarcely indicated; veins brown, those in the brightened fields paler brown. Venation: *Sc*₁ ending a short distance before origin of *Rs*, *Sc*₂ far from its tip, *Sc*₁ alone being more than one-third *Rs*; cell 1st *M*₂ shorter than vein *M*₄; *m-cu* at or shortly before the fork of *M*.

Abdominal tergites brown; sternites paler; hypopygium brownish yellow. Male hypopygium with the dististyle terminal in position, entirely fleshy, relatively large, the length being about one-fifth that of the basistyle; shape roughly rectangular; two fasciculate setæ, one from the outer mesal angle, the second from near mid-width of the truncated apex; mesal edge of style with a row of five or six normal but elongate setæ, the face of style with an oblique row of four or five similar ones, the row reaching almost to the base of style. Phallosome a simple pale cup-like structure, with a single elongate element jutting therefrom, this presumably being the ædeagus, tapering gradually to a very delicate point.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, Rio Arajuno, Napo Watershed, altitude 1000 metres, April 22, 1941 (*Macintyre*).

The present species has the hypopygium most like that of the Mexican *Gonomyia* (*Lipophleps*) *haploides* Alexander, which differs in the coloration of the body and in the details of structure of the male hypopygium, especially the size, shape and vestiture of the dististyle.

Gnophomyia (*Gnophomyia*) *tungurahwana*, sp. n.

Allied to *mæstitia*; general coloration dark plumbeous grey; antennæ black throughout; legs brown, the tarsi passing into black; wings weakly bicolored, the basal two-thirds brown, the outer third more greyish brown; male hypopygium with the caudal margin of tergite gently emarginate, bordered by virtually continuous rows of spinous setæ, lateral tergal angles produced into distinct tubercles that are tipped with about ten similar setæ of various sizes; a setiferous tubercle at proximal end of mesal face of basistyle; outer dististyle long and slender; inner dististyle terminating in a small apical tooth; distal portion of style with unusually strong setæ.

Male.—Length about 5.5–5.6 mm.; wing 5.3–5.5 mm.; antenna about 2 mm.

Rostrum and palpi brownish black. Antennæ black; flagellar segments long-oval, the outer ones conspicuously smaller; longest verticils slightly exceeding the segments in length. Head grey, the vertex with a brown central spot.

Thorax chiefly dark plumbeous grey, the pretergites restrictedly paler; central portion of mesonotum not

visible in type, due to the mounting. Pleura grey, the meral region light yellow. Halteres infuscated. Legs with the coxæ dark grey; trochanters brown; remainder of legs brown, the femora paler on ventral surface; tarsi darkening to black. Wings weakly bicoloured, the basal two-thirds to beyond the general level of cord brown, the outer third paler greyish brown, this colour likewise including the anal cells; stigma elongate-oval, darker brown; veins dark brown. Venation: Sc_1 ending shortly before the level of the outer end of vein R_{2+3+4} ; R_{2+3} a little longer than vein R_2 ; cell 1st M_2 long and narrow, only slightly widened outwardly, subequal in length to vein M_4 beyond it; $m-cu$ at near mid-length of cell. In both wings of type with an extra cross vein in cell R_3 .

Abdomen brown, the tergites darker than the sternites; pleural membrane yellow. Male hypopygium with the tergite large and conspicuous as in the group, its caudal margin broadly and gently emarginate, bordered by virtually continuous rows of elongate blackened spinous setæ, these rows being approximately three deep and totalling in excess of 60 spines; lateral angles of tergite produced into a conspicuous lobe that is tipped with about ten further similar setæ of unequal lengths, a single one being unusually strong and powerful. In *kerteszi* the row of spinous setæ is single or virtually so and is interrupted at the mid-line. Basistyle with a setiferous tubercle on proximal end of mesal face, but without modified spines such as are found in *coxitalis*. Outer dististyle long and slender, gently curved, the blackened tip subobtusate. Inner dististyle less than half as long, terminating in a small apical blackened tooth, the distal two-thirds of style with unusually strong coarse setæ, with fewer longer and more delicate ones on outer portion.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Mount Tungurahua, altitude 3000 metres, May 12, 1937 (*Macintyre*). *Paratopotype*, ♂.

Among the now rather numerous described species that are allied to *Gnophomyia* (*Gnophomyia mæstitia* Alexander, the present fly is closest to *G. (G.) coxitalis* Alexander and *G. (G.) kerteszi* Alexander, both of which have the outer lateral angles of the male hypopygium produced but of entirely different conformation and

armature from that of the present fly. The details of the basistyle and dististyles are distinctive in all three species.

Styringomyia dorsolineata, sp. n.

General coloration brownish yellow, patterned with brown; abdominal tergites with a nearly continuous median brown stripe that is narrowly broken at near mid-length of the individual segments.

Male.—Length about 8 mm., wing 5.5 mm.

Female.—Length about 5.5 mm., wing 5 mm.

Rostrum pale brown, palpi darker brown, especially the outer segments. Antennæ with the scape infuscated beneath, yellow above, pedicel brown, flagellum yellow. Head light yellow, the centre of vertex more or less infuscated; setæ of vertex erect, slender.

Thoracic notum obscure brownish yellow, the sides of the postnotal mediotergite darker brown, the præscutal humeri more pruinose. Legs yellow, the fore and middle femora with a narrow brown subterminal ring and with the basal half or more weakly infuscated, tips of tibiæ narrowly infuscated; terminal tarsal segment abruptly darkened. Wings yellow: a restricted dark cloud over anterior cord; veins yellow, the outer medial ones more infuscated. Venation: Cell 2nd M_2 barely sessile or very short-petiolate; vein 2nd A gently curved to the margin.

Abdomen of male broken at mid-length of fourth segment; tergites yellow, the posterior rings with a conspicuous brown triangle, the basal rings a little less intensely darkened, the general effect being of a continuous dark median stripe that is barely interrupted on the proximal portion of outer ring of the segment, sternites uniformly yellow. Ovipositor with the tips of the cerci produced into a slender extension, its tip truncate and glabrous, less extensively so than in *mystica*.

Hab. Ecuador (El Oro).

Holotype, a broken ♂. Morro Morro, altitude 1500 metres, July 20, 1941 (*Laddey*). *Allotopotype*, ♀.

Styringomyia dorsolineata seems well-distinguished from the other Neotropical species of the genus in the pattern of the basal abdominal tergites which are much more heavily marked than in either *S. americana* Alexander or *S. mystica* Alexander. It is unfortunate that the hypopygium of the holotype male is lost, since the decisive specific characters are to be found in this structure.

XXXIX.—*A Correction and Additional Data to two former Papers on Opilionids and Diplopods from Indian Caves* *.

By F. A. TURK, Ph.D., F.Z.S., F.R.E.S.

In the papers referred to, published in previous parts of these 'Annals,' the locality of the Cave of Moila Swallet is given as Bundelkhand. This was so recorded because the specimens were sent to me from Monghyr Bundelkhand and were accompanied by no other data than the name of the cave. In a letter dated 5. viii. 45, Brigadier E. A. Glennie, the discoverer of these forms, points out that this is an error and that the full description of the locality should be "Moila Swallet, height 8700 feet, Chakrata Tahsil, Dehra Dun District, United Provinces, India."

From the point of view of distribution this correction is important, as Bundelkhand is on the Peninsular Shield and, at the time of the elevation of the Himalayas and long afterwards, would have been separated from them by the Indo-Gangetic Trough.

Brigadier Glennie adds the information that this particular cave has a uniform temperature throughout the year of 49° F. This is remarkably similar to large English caves, the temperature of which is between 49° and 50° F.

The implication of this additional data on the question of the existence of an Indo-Madagascan land-bridge is difficult to assess. The elevation is nearly that (9000 feet). which, by general acceptance, is taken as the meeting point of the characteristic Himalayan fauna derived, in part, from the Indian Plains and that derived from a Palearctic source. It seems likely, therefore, that these forms represent a late modification of the ancestral type, induced by the cavernicolous mode of life: as exemplified in the better known European fauna the limits of the distribution of certain families and genera are marked by cave-inhabiting species.

* "On Two Diplopods of the Family Vanhoeffeniidae from Indian Caves, with the Description of a new Genus," *Ann. & Mag. Nat. Hist.* (11) vol. xii. p. 38, Jan. 1945.

"New Opilionids (Laniatores) from Indian Caves," *Ann. & Mag. Nat. Hist.* (11) vol. xii. p. 202, March, 1945.

XL.—New Species of Chrysomelidæ (Cryptocephalinæ, Eumolpinæ and Halticinæ, Col.) from Java and Fiji.
By G. E. BRYANT, Imperial Institute of Entomology.

ALL the types of the following new species are in the British Museum (Natural History) :—

CRYPTOCEPHALINÆ.

Loxopleurus costipennis, sp. n. (Fig. 2.)

Flavous, the prothorax with a median black stripe, broadest at the anterior margin, gradually narrowing to a point at the base, the elytra with the basal margin and the suture narrowly black, finely punctate-striate, costate between the striæ.

Length 2-2.5 mm.

Head flavous, flattened, impunctate, the eyes strongly notched opposite the insertion of the antennæ. The antennæ⁴ extending to the middle of the elytra, the five basal segments⁵ flavous, with the apical portion of each fuscous, the six terminal segments black and pubescent, the first segment the longest, longer than the second and third together. Prothorax broadest at the base, the sides contracted in front, an oblique impression just behind the middle of the side-margins, flavous with a median black stripe, broadest at the anterior margin, narrowing into a point at the base, a few very fine scattered punctures. Scutellum black, oblong. Elytra flavous, the basal margin and the suture narrowly black, a black spot on the shoulders, and the margin at the apex black, punctate-striate, the intervals between the striæ slightly costate. Legs flavous. Underside flavous, clothed with fine golden pubescence, the apical segment paler. ♀ differs in being larger and in having the black markings less well defined, and the apical ventral segment of the abdomen with a deep fovea.

Fiji Is. : Suva, 13. x. 1943 (R. A. Lever), 7 specimens.

Allied to *L. leveri* Bry., but slightly smaller and the black pattern differently placed and the elytra costate.

EUMOLPINÆ.

Nodostoma greenwoodi, sp. n. (Fig. 4.)

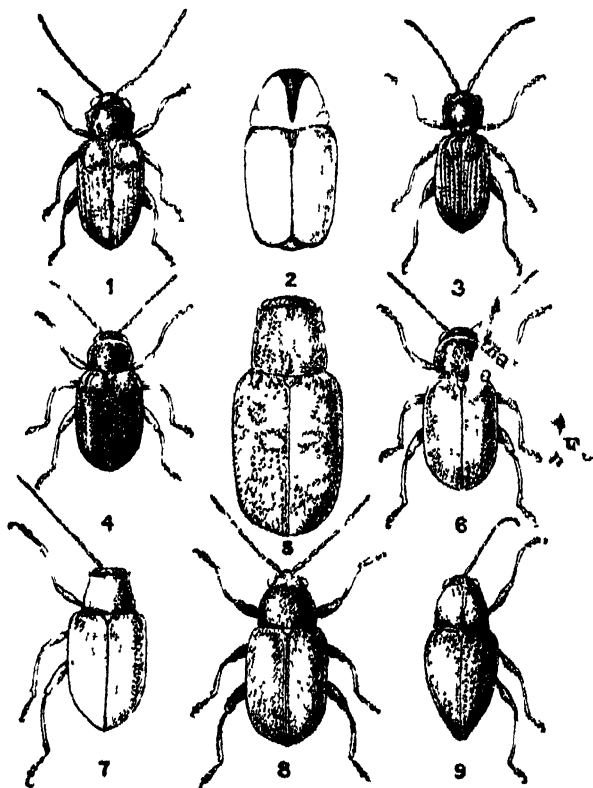
Nitid, the head fulvous, impunctate, prothorax black, with the anterior margin broadly fulvous, the elytra

black, with the basal portion fulvous, antennæ and legs flavous.

Length 2.5 mm.

Head nitid, fulvous, the basal portion darker, impunctate, the labrum fuscous. Antennæ long and slender,

Figs. 1-9



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| 1. <i>Manobia metallica</i> , sp. n. | 6. <i>Nodostoma strigosu</i> , sp. n. |
| 2. <i>Loxopleurus costipennis</i> , sp. n. | 7. <i>Vitsbia vitienis</i> , sp. n. |
| 3. <i>Alema leveri</i> , sp. n. | 8. <i>Stygnobia metallica</i> , sp. n. |
| 4. <i>Nodostoma greenwoodi</i> , sp. n. | 9. <i>Stethotes rufipes</i> , sp. n. |
| 5. <i>Demotina javanensis</i> , sp. n. | |

flavous, the first segment twice as long as the second, each more dilated than the following three, which are very slender and about equal to each other. Prothorax transverse, the sides slightly rounded, very nitid, black,

with the anterior margin broadly fulvous, strongly but not closely punctured. Scutellum black, nitid, triangular. Elytra nitid, black, with the basal portion fulvous, and the apex tinged with fulvous, impressed near the shoulders, strongly punctate-striate, the punctures rather wide apart, the intervals between the striæ at the sides slightly costate. Legs entirely flavous, the intermediate and posterior tibiae emarginate at the apex. Underside black.

FLJI Is.: Lautoka, 2, iv. 1920 (W. Greenwood), 1 specimen.

Allied to *N. vitiensis* Bry., but much more strongly punctured.

Demotina javanensis, sp. n. (Fig. 5.)

Oblong, subcylindrical, black, the elytra with a fulvous tinge, the prothorax and elytra very strongly punctured, clothed with whitish scales, which on the elytra form a few white patches.

Length 3 mm.

Head black, clothed with scattered white scales, strongly punctured, the punctures round and deep, the labrum fulvous, the eyes round. Antennæ fulvous, extending slightly beyond the base of the elytra, the two first segments more dilated than the third to the sixth, the five terminal segments more dilated than the sixth. Prothorax subquadrate, black, clothed with adpressed white scales, very strongly punctured, the punctures round and deep, the sides slightly contracted in front before the middle. Scutellum fuscous, impunctate, the apex rounded. Elytra with the sides parallel and the apex rounded, black, with a fulvous tinge, clothed with white scales, the scales at the base forming three white patches, another at the middle near the suture, and a larger one near the apex, on each elytron. Legs black, very rugose, the femora strongly punctured and clothed with white scales, the anterior femora armed with a small tooth. Underside black, clothed with white scales, the ventral segments two to four equal.

JAVA: Buitenzorg, v. 1912, on cocoa. Forwarded by the "Institute for Plant Diseases."

Allied to *D. sumatrana* Baly, but differs in its darker colour, the prothorax not so broad, but more elongate, and in the much coarser puncturation.

Nodostoma strigosa, sp. n. (Fig. 6.)

Metallic black, the anterior margin of the prothorax narrowly fulvous, antennæ with the six basal segments flavous, the remainder fulvous, the tibiæ and tarsi fulvous, the head strigose, the prothorax not closely punctured, the elytra strongly punctate-striate.

Length 3 mm.

Oblong, the head black, strigose, the labrum fulvous. Antennæ slender, extending to the middle of the elytra, the six basal segments flavous, the remainder fulvous, the third to the sixth about equal and more slender than the two basal segments. Prothorax metallic black, with the anterior margin narrowly fulvous, the sides rounded at the base and slightly contracted in front, strongly but not closely punctured. Scutellum black, quadrate, impunctate. Elytra metallic black, the sides parallel and rounded at the apex, very strongly punctate-striate, the punctures stronger than on the prothorax. Legs with the femora fuscous, the tibiæ and tarsi fulvous, the intermediate and posterior tibiæ emarginate at the apex. Underside black, the mesosternum with a few strong punctures, the first ventral segment of the abdomen twice as long as the second.

FLJ Is.: Tamavua. 3. iv. 1927: 7. vi. 1927 (*H. W. Simmonds*), 5 specimens.

Differs from *N. vitiensis* Bry. in colour, its more oblong shape, and in the much stronger and more regular puncturation.

Vitibia vitiensis, sp. n. (Fig. 7.)

Oblong ovate, convex, entirely fulvous, nitid, prothorax with a few very fine scattered punctures, the elytra punctate-striate, less strongly punctured towards the apex.

Length 3-4 mm.

Head fulvous, nitid, the basal portion impunctate, the front more rugose. Antennæ fulvous, long and slender, extending just beyond the middle of the elytra, the first segment almost twice as long as the second, the third to the sixth long and more slender than the five apical segments. Prothorax fulvous, very nitid, with a few very fine scattered punctures, about as broad as long, all the angles slightly produced, the sides feebly rounded and contracted in front. Scutellum fulvous,

triangular impunctate. Elytra fulvous, much broader than the prothorax, oblong, the sides parallel, the apex subacutely rounded, punctate-striate, the punctures less marked towards the apex. Legs fulvous, long and slender, the intermediate and posterior tibiæ emarginate at the apex. Underside fulvous, with fine scattered golden pubescence.

Fiji Is.: Mt. Victoria, vii. 1940, C. 1049. Forwarded by R. A. Lever (*Collector Despeissis*), 2 specimens.

Up to the present there are only two described species of *Vitibia*, *V. formosa* Baly, from the New Hebrides, and *V. rufoviolacea* Fairm., from Fiji, from which this species differs in size and colour.

Stygnobia metallica, sp. n. (Fig. 8.)

Dark metallic green, clothed with grey pubescence, the antennæ flavous, with the two apical segments fuscous, the anterior and middle tibiæ flavous, with the basal third dark green, the posterior tibiæ flavous, with the basal half dark green, prothorax and elytra strongly punctured.

Length 3 mm.

Head dark metallic green, strongly but not closely punctured, the frontal portion almost impunctate. Antennæ long and slender, extending to the middle of the elytra, pale flavous, the two apical segments fuscous, the first two segments more dilated, the first slightly longer than the second, the third about equal to the second, the fourth longer than the third. Prothorax dark metallic green, clothed with fine grey pubescence, strongly and closely punctured, widest at its base, the sides from the middle contracted in front and feebly margined. Scutellum dark metallic green, impunctate, subquadrate. Elytra dark metallic green, clothed with fine grey pubescence, irregularly punctate-striate, the sides behind the middle tapering to the apex. Legs with the femora dark green, the anterior and middle tibiæ pale flavous, with the basal third dark green, the posterior tibiæ pale flavous, with the basal half dark green, all the tarsi pale flavous. Underside dark metallic green, the meso- and metasterna strongly punctured, the ventral segments of the abdomen more finely punctured and pubescent.

Fiji: Taveuni, 12. iii. 1945, No. C. 1706 (*R. A. Lever*), 5 specimens.

Distinguished from all the described species of *Stygnobia* by its metallic colour.

Stethotes rufipes, sp. n. (Fig. 9.)

Ovate, narrowing posteriorly, black, pubescent along the suture of the elytra, prothorax more strongly punctured than the elytra, the antennæ flavous, the legs rufous.

Length 3 mm.

Head rufous, the interocular space almost impunctate, the basal portion somewhat strigose. Antennæ flavous, extending slightly beyond the middle of the elytra, the two basal segments more dilated, the first about twice as long as the second, slightly club-shaped, the second more rounded, the remainder elongate and narrower. Prothorax black, slightly transverse, widest just before the base, the sides contracted in front, very strongly punctured, the anterior half with the punctures in the median portion more strigose. Scutellum black, triangular. Elytra black, somewhat nitid, punctate-striate, the punctures not very close together, the suture with a row of pale transverse pubescence, the sides of the elytra strongly narrowed posteriorly. Legs long and rufous, the femora punctate. Underside more or less rufous.

FLJI Is.: Mt. Lautoka, 22. viii. 1920 (W. Greenwood), 2 specimens; Loloti, 19. xii. 1920 (W. Greenwood), 2 specimens.

Somewhat allied to *S. rufonigra* Mlk., from Samoa, but differs in colour, and the puncturation of the prothorax stronger and closer and the elytra more narrowed posteriorly.

Pseudostonopa striatipennis, sp. n.

Chestnut-brown, the prothorax much darker, the elytra with alternate dark and chestnut stripes, female with only the sides and apex chestnut, finely punctate-striate.

Length 4-5 mm.

♂♀. Subquadrately ovate, head chestnut brown, the clypeus slightly darker, strongly punctured, the vertex finely punctured, with a short median longitudinal impression. Antennæ chestnut-brown, filiform, extending to the middle of the elytra, the first segment the longest and more dilated, the second slightly shorter than the third, the third to the apical all more or less equal. Prothorax transverse, almost black, with the anterior

and lateral margins tinged with chestnut, very finely punctured, the sides slightly rounded, and all the angles produced. Scutellum subtriangular, chestnut-brown, impunctate. Elytra very little broader at the base than at the base of the prothorax, the sides rounded, widest behind the middle, male with alternate pale and dark stripes between the striae, which are finely punctate-striate, female with the sides, apex and suture paler, not striped. Legs chestnut-brown. Underside with the sternum darker, the ventral segments of the abdomen chestnut, with a few scattered punctures and short pubescence, the first two segments the longest, the third and fourth shorter and about equal.

JAVA: 29. vi. 1934 (*L. G. E. Kalshoven*), 4 specimens.

Allied to *P. bicolor* Jac., but larger and more ovate, colour and markings different.

HALTICINÆ.

Manobia metallica, sp. n. (Fig. 1.)

Elongate-ovate, dark metallic green, with the antennæ and legs flavous, the base of the prothorax punctured, the elytra punctate-striate, the intervals near the side-margins slightly costate.

Length 2 mm.

Head shining dark metallic green, impunctate. Antennæ flavous, extending to the middle of the elytra, the first segment twice as long as the second, the second shorter and more rounded than the third, the third to the sixth elongate and slender, the five terminal segments slightly more dilated. Prothorax shining dark metallic green, the sides slightly contracted to the base, feebly margined, and the anterior angles oblique, very finely punctured, with the punctures across the basal portion much stronger. Scutellum fulvous, triangular, impunctate. Elytra deep metallic green, punctate-striate, with the intervals near the side-margins slightly costate, a transverse depression near the base, and the shoulders raised and prominent. Legs flavous, the posterior femora tinged with fuscous. Underside fuscous.

FLJI Is.: Tomaniivi, 6. vii. 1944, 3,000 ft., No. C. 1604 (*R. A. Lever*), 2 specimens.

Somewhat allied in structure to *M. costata* Bry., from the New Hebrides, but differs in colour and the elytra much less costate.

Alema leveri, sp. n. (Fig. 3.)

Shining black, except the second to the sixth segments of the antennæ, fulvous, the elytra punctate-striate with the intervals costate.

Length 2 mm.

Head black, shining, impunctate, the eyes large and prominent. Antennæ long and slender, extending to the middle of the elytra, the basal and the five terminal segments black, the remainder fulvous, the first segment long and slightly dilated, about equal to the second and third together, the second shorter and more dilated than the third, the third to the sixth about equal to each other and more slender than the five terminal segments. Prothorax shining black, subquadrate, the sides feebly margined and contracted towards the base, a transverse depression near the base containing a few strong punctures. Scutellum black, triangular, impunctate. Elytra elongate, tapering to the apex, black, shining, strongly punctate-striate, with the intervals costate. Legs black, the first segment of all the tarsi elongate. Underside black.

Fiji Is.: Taveuni, Crater Lake, 12. iii. 1945, C. 1706 (*R. A. Lever*), 1 specimen.

Allied to *A. nigra* Bry., but differs in the strongly punctured and costate elytra, and in having the legs black.

NOTE.

The Mallophagan Genus Virgula.

Dr. Guimares has kindly drawn my attention to the fact that *Virgula* Clay, genotype *Gonoidea meleagridis* (Linné) ('Parasitology,' vol. xxxiii. no. 1, March 1941, p. 119) is pre-occupied by *Virgula* Simpson, 1900, Proc. U.S. nat. Mus. xxii. p. 931. I have recently seen an article on Mallophaga by A. K. Merisuo (Ann. Ent. Fennici, no. 4, vol. x. 1944, p. 213) in which is listed the genus *Chelopistes* Kéler with the species *meleagridis* Linné. It can be presumed, therefore, that some time since the summer of 1939 Dr. Kéler erected the genus *Chelopistes* for those species included in *Virgula* Clay. As *Virgula* Clay is pre-occupied, the name *Chelopistes* Kéler, whether described prior or subsequent to March 1941, becomes the new name for *Virgula* Clay.

Theresa Clay.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 91. JULY 1945.

XLI.—*New Curculionidæ (Col.) from Tropical Africa.*

By Sir GUY A. K. MARSHALL, K.C.M.G., F.R.S.

THE types of the following new species have been deposited in the British Museum (Natural History) :—

BRACHYDERINÆ.

THAPTOGENIUS, gen. n.

Head continuous with rostrum, but sometimes with a very fine stria between them at the sides ; eyes prominent, separated from the prothorax by half their length or less. *Rostrum* transverse, about as long as the head, rather deeply incised at apex, without any definite epistome ; scrobes short, rapidly becoming wide and shallow behind, but the scape, when at rest, passing well below the eye ; mandibles very large, smooth and convex, without scales but with 4–6 setæ, all placed on the outer side of the unusually small scar ; mentum small, immersed, bearing two setæ. *Antennæ* long and slender, without any scaling ; scape passing the front margin of the prothorax, abruptly clavate ; funicle with the joints elongate, 1 much longer than 2 ; club elongate, fusiform, hardly wider than the knob of the scape. *Prothorax* truncate at base and apex, finely marginate at base, without postocular vibrissæ. *Scutellum* not elevated between the elytra, the scutellar area flat and on a level with the mesonotum. *Elytra* soldered together, not marginate at base but sloping

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rather steeply down to the mesonotum, without any humeral callus, with ten complete striæ, the lateral margins reaching the hind coxæ. *Wings* entirely absent. *Legs* slender; femora unarmed; tibiæ not mucronate, the corbels open and not ascending; tarsal claws connate. *Sternum* with the mesepimera remote from the base of the elytra; metasternum about as long as a median coxa, the metepisternal suture entirely obliterated. *Venter* with the three intermediate ventrites equal, ventrite 1 behind coxa shorter than 2, its posterior margin truncate.

Genotype: *Thaptogenius glaucus*, sp. n.

This genus belongs to the tribe Brachyderini, which is not well represented in Africa, and in Dr. van Emden's Key (Ann. & Mag. N. H. (11) xi. 1944, p. 528) runs down to *Epiphaneus* (Asia Minor). The latter genus has the rostrum much longer than the head and as long as broad, the mandibles being densely setose and squamose, with a large prominent oblique scar; joint 2 of the funicle is as long as 1; the base of the elytra is vertical and the mesonotum not exposed; the mesepimera reach the base of the elytra; ventrite 1 behind the coxa is as long as 2, which is much longer than 3.

Thaptogenius glaucus, sp. n.

♂♀. Derm rather dull black, usually with a slight greenish reflection, and rather thinly clothed, above and below, with narrow whitish scales, which are denser on the sternum.

Head with shallow punctures that are separated in ♀, closer and often subconfluent in ♂, with a small shallow median fovea. *Rostrum* narrowing slightly from base to apex, not dilated at the genæ; dorsum broad and flat, rounded off at its lateral margins, with longitudinally confluent shallow punctures and a shiny impunctate median stripe, which is much broader in ♀, and with fairly dense scaling. *Antennæ* very slender, varying from entirely red to blackish with the basal half of the scape red, but usually red with the club and the apices of the other joints blackish: joint 3 longer than 4, 6 and 7 equal. *Prothorax* transverse (4:3♂, 3:2♀), feebly rounded laterally, widest at about middle, very slightly narrower at base than at apex; dorsum flat longitudinally, with very shallow, transversely confluent punctures on the disk, gradually turning into small flattened granules

laterally, without any smooth median line. *Elytra* narrowly ovate in ♂, much broader in ♀ with the basal slope steeper; the striae feebly impressed, with small shallow separated punctures, the intervals flat, finely aciculate transversely. *Legs* with rather sparse narrow whitish scales; tarsi of ♂ much longer than those of ♀ and the tibiae more hairy.

Length 4.5–5.6 mm., breadth 1.6–2.6 mm.

KENYA: Nandi Plateau, 5,700–6,300 ft., 8 ♂, 4 ♀, v.–vi. 1911 (*Dr. S. A. Neave* –type), Yala R., S. edge of Kakumega Forest, 4,800–5,300 ft., 1 ♂, 1 ♀, v. 1911; N. Kavirondo, valley of Upper Nzoia R., 5,100–5,400 ft., 3 ♂, 2 ♀, vi. 1911; south foot of Mt. Elgon, 5,100–5,800 ft., 1 ♂, vi. 1911 (all *S. A. N.*).

Thaptogenius xreus, sp. n.

♀. Very closely allied to the genotype, but the derm entirely bronze, the scales being much narrower and setiform.

Rostrum a little longer, with the margins of the dorsal area more angulate and the lateral areas almost vertical, the median impunctate stripe longer and narrower in ♀. *Elytra* slightly more narrowed behind, the basal slope less steep, the striae more impressed and the intervals more convex.

Length 6 mm., breadth 2.7 mm.

KENYA: Nandi Plateau, 5,700–6,000 ft., 1 ♀, v.–vi. 1911 (*Dr. S. A. Neave*).

Omotrachelus bigranulatus, sp. n.

♂♀. Derm dull black; head and prothorax with dense brassy scaling, but nearly always obscured by an earthy covering; elytra with the brassy scaling unevenly distributed, leaving many irregular bare patches, the inflexed lateral areas quite bare; underside with dense brown scales, those on the basal half of the venter being elongate, suberect, and more or less fringed at the apex.

Head subconical, eyes almost flat, the upper edge on a level with the side of the frons, which is deeply depressed in the middle. *Rostrum* longer than broad, almost parallel-sided; dorsum rapidly narrowing in front, with a shallow median furrow and a marginal row of erect clavate setae; genae with similar sparse setae; epistome elevated, devoid

of scaling, its upper surface sloping almost vertically forwards. *Antennae* red-brown; funicle with joint 1 longer than 2, 3-6 equal, bead-like and slightly transverse, 7 much broader. *Prothorax* twice as broad as long, strongly rounded laterally, widest at about the middle; dorsum with very coarse deep punctures, which are almost or quite concealed by dense scaling and an earthy covering, but with a curved transverse impression across the disk and with sparse erect clavate setae. *Elytra* longer than their greatest width (11 9), as wide as the base of the prothorax at their base and there parallel for a short distance, then rapidly widening with the sides straight to one-fourth from the base, where there is a more or less distinct angle, the sides then becoming parallel to beyond the middle, and broadly rounded behind, the dorsal outline only gently curved, highest at the middle, the posterior declivity becoming vertical near the apex; the striae broad and shallow, containing shallow distinct punctures; the basal margin broadly and obtusely elevated, intervals 3 and 5 slightly more raised than the adjoining ones, the sutural area with a subquadrate depression adjoining the basal elevation and immediately behind it a round shining black granule on each side of the suture, the scaling mostly on the intervals and only partly in the striae, intervals 3, 5, 6 and the apical half of 2 with a row of suberect or subrecumbent clavate setae.

Length 3.0-3.7 mm., *lat.* 1.7-2.4 mm.

S. NIGERIA: Esosong, 21 ♂, 13 ♀, iv. 1945 (*F. D. Golding*).

Recorded by Mr. Golding as attacking young cinchona trees in the nursery.

Distinguished from all the six species described previously by the two shining black granules on the suture at one-fourth from the base.

Genus *IPHISOMUS* Faust.

The species placed in this genus in the 'Coleopterorum Catalogus' (parts 131 and 153) are certainly heterogeneous. The confusion is partly due to a general misunderstanding of the structure of the mandibles in the genotype (*faloiger* Gerst.). As the specific name indicates, each mandible bears a long stout curved process, which has hitherto been regarded as the temporary deciduous piece that is characteristic of the vast majority of adelognathous weevils.

But this structure differs from all known types of deciduous mandibles in that it is coarsely punctate and bears numerous long erect setae; moreover it is present in every specimen of those species in which it occurs. Examination has shown that this is not a false mandible but a solid process of the mandible itself, the deciduous piece being attached to its apex. A somewhat similar process, on a smaller scale, may be seen in the Tanymericine genus *Leptoscapus* Faust, especially in *denticollis* Thoms.

The only species in which this character occurs are:—

<i>falciger</i> Gerst.	<i>mandibularis</i> Hust.
<i>gracilicornis</i> Hust.	<i>naupactoides</i> Fairm.
<i>ignavus</i> Mshl.	<i>sægeri</i> Hust.

Two cotypes of *naupactoides* in the British Museum are undoubtedly conspecific with *falciger*, the distinctions given by Fairmaire being quite unreliable (n. syn.).

These five species thus constitute the real genus *Iphisomus* and differ from all the others hitherto associated with them not only in the form of the mandibles, but also in having no discal carinae in the rostrum, and in having the intercoxal process of the mesosternum unusually narrow.

The species can be distinguished by the following characters:—

- | | |
|--|----------------------------|
| 1 (8). Front femora without a tooth; head and rostrum not wrinkled longitudinally; scales simple. | |
| 2 (5). Base of elytra with a carinate margin. | |
| 3 (4). Elytra with a small conical tubercle near base of interval 7; dorso-lateral carinae on rostrum almost straight and parallel (E. Africa) | <i>falciger</i> Gerst. |
| 4 (3). Elytra without any subbasal tubercle; dorso-lateral carinae on rostrum distinctly sinuate (Transvaal) | <i>ignavus</i> Mshl. |
| 5 (2). Elytra steeply declivous at base but not marginate. | |
| 6 (7). Elytra with the rows of punctures duplicated and somewhat irregular, the declivity with long erect slender setae (Congo) | <i>sægeri</i> Hust. |
| 7 (6). Elytra with the rows of punctures normal and quite regular, the declivity with very short suberect broad setae (Congo) | <i>gracilicornis</i> Hust. |
| 8 (1). Front femora with a small tooth; head and rostrum closely wrinkled longitudinally; scales bearing a puncture (Angola) | <i>mandibularis</i> Hust. |

The remaining species standing under *Iphisomus* in the 'Catalogue' may be divided into four genera, as follows:—

- | | |
|--|-----------------------------|
| 1 (2). Front tibiae curved inwards at apex, corbels of hind pair not ascending the dorsal edge; mentum with two setae | <i>Cnemecamptus</i> , g. n. |
| 2 (1). Front tibiae straight dorsally. | |
| 3 (4). Corbels of hind tibiae shortly ascending, the dorsal part as long as the apical; mentum with a group of 3 or 4 setae on each side | <i>Orthoscelus</i> , g. n. |
| 4 (3). Corbels of hind tibiae not ascending; mentum with not more than four setae. | |
| 5 (6). Rostrum with sublateral sulci or carinae, mentum with not more than two setae; eyes more or less convex, laterally exceeding the line of the temples; elytra wider than the prothorax | <i>Lipsumus</i> , g. n. |
| 6 (5). Rostrum without any sublateral sulci or carinae, mentum with four setae; eyes flat, not exceeding the temples; elytra not wider than the prothorax. | <i>Syringotypus</i> , g. n. |

The six species of *Iphisomus* described from Madagascar are unknown to me and are not included here as the descriptions are inadequate. All that can be said is that they do not belong to the genus *Iphisomus* as here restricted.

CNEMECAMPTUS, gen. nov.

The following species are included in this genus, of which *Iphisomus depressus* Mshl. is the genotype:—

- | | |
|---|--------------------------|
| <i>brunneus</i> Hust. 1919 (<i>Siderodactylus</i>). | |
| <i>cinereus</i> Hust. | <i>ovalipennis</i> Hust. |
| <i>denticulatus</i> Hust. | <i>perforatus</i> Hust. |
| <i>depressus</i> Mshl. | <i>physapus</i> Fairm. |
| <i>elegans</i> Hust. | <i>silaceis</i> Hust. |
| <i>mysticus</i> Fst. | <i>viridanus</i> Fst. |
| <i>opacus</i> Hust. | <i>zuluensis</i> Mshl. |

There can, however, be no doubt that the female of Faust's *viridanus* was really only a large male, and that the true female was his *mysticus*, described from the same material (n. syn.). In the 'Catalogue' this species has been transferred to the Oriental genus *Lepropus*; but the

typical species of this latter genus differ in having true shoulders to the elytra and the mentum is multisetose.

Cnemecampus gularis, sp. n.

♂. Derm black, with fairly dense grey or brownish scaling which is often more sparse on intervals 5-8 on the elytra, forming a broad darker stripe, especially in ♀.

Head rugosely punctate, with small shining black granules showing through the scaling; frons flat, eyes moderately convex. *Rostrum* parallel-sided in the basal half, dilated apically, in lateral view deeper at apex than at base; dorsum broadly depressed down the middle but without any transverse impression at base. *Antennæ* black, with joint 7 of the funicle slightly shorter than 6. *Prothorax* somewhat transverse, rapidly widening from the apex to before the middle, thence almost parallel-sided to an abrupt deep basal constriction, shallowly constricted near the apex, the constriction continued broadly and shallowly across the disk; dorsum closely set with small punctigerous granules, the scales being principally in the interstices and not forming rosettes; gular margin with a small conical tubercle in front of each coxa. *Elytra* narrowly elliptical in ♂, broader in ♀, without any apical mucro in either sex; the shallow striae containing comparatively large punctures that are more or less concealed by scaling; the slightly convex intervals broader than the striae and with a row of very short, recumbent or subrecumbent, spatulate setæ, interval 7 in both sexes with a small angulate tubercle near the base, interval 8 strongly costate for three-fourths of its length in ♀ only.

Length 8.5-11.0 mm., breadth 2.8-4.5 mm.

KENYA: Mombasa, 3 ♂, 3 ♀, vii. 1938 (R. E. Dent).

Nearly allied to the grey variety of *C. viridanus* Fst., which differs in having a shallow transverse depression at the base of the rostrum; the eyes are much more strongly convex; the granules on the prothorax are much larger and flattened, the scales being arranged on them in rosettes with the interstices bare, and the gular margin lacks the two small tubercles: and the apices of the elytra are produced jointly into a short mucro in ♂ and a longer one in ♀.

ORTHOSCELUS, gen. nov.

This genus contains only two species : *municanus* Mshl. and *swynnertoni* Mshl. (genotype).

LIPSANUS, gen. nov.

This genus comprises the following species :—

- brunneus* Hust. 1925 (*Piazomias*).
- cuprescens* Mshl. 1918 (*Sympiezomias*).
- excisipes* Mshl. 1939 (*Iphisomus*).
- kalaharicus* Hesse.
- peregrinus* Pascoe (genotype).
- viridanus* Fhs.

SYRINGOTYPUS, gen. nov.

This genus contains only a single species, *Sympiezomias cylindricus* Hust., 1934, from the Belgian Congo, which has a very characteristic facies and certainly does not belong to the Oriental genus *Sympiezomias*.

OTIORRHYNCHINÆ.

Nematocerus productus, sp. n.

♂♀. Derm shiny bronze, almost bare but with sparse short subrecumbent whitish setæ on the apical half of the elytra, especially in ♀; extreme lateral margin of elytra with a thin stripe of narrow white scales, which are often abraded, especially on the apical half.

Head with sparse shallow punctures; frons very slightly convex transversely, with a variable shallow median stria; eyes moderately convex. Rostrum about as long as its width at the genæ, narrowing from base to middle and widening again to apex; dorsum almost flat, with shallow, often partly confluent punctures and a low obtuse median carina, the lateral margins obtuse, not carinate. Antennæ black to piceous; scape of ♂ broad, compressed and very abruptly clavate, that of ♀ slightly shorter, much broader and with a much larger knob; funicle with all the joints elongate, 1 nearly as long as 2+3, 7 longer than 3. Prothorax nearly as long as broad in ♂, more transverse in ♀, moderately rounded laterally, widest at about middle, shallowly constricted at

apex which is not narrower than base; dorsum closely covered with extremely flattened, transversely confluent granules. *Elytra* of ♂ very narrowly ovate, widest at about one-fourth from base, narrowing thence to the obtusely acuminate apex, the dorsal outline forming a flat curve which becomes almost vertical close to apex; *elytra* of ♀ much broader near base and much more narrowed behind, where they are sharply acuminate, the dorsal outline more convex, the posterior declivity overhanging, forming a process that projects for at least 1 mm. beyond the true apex; the impressed striæ containing small shallow punctures that are often subgranulate in the basal half and diminish or even disappear behind, the broad intervals finely transversely aciculate. *Legs* black, with sparse short white setæ; hind tibiæ of ♂ with the inner face curved, flattened and with low coarse granules, the front pair truncate at apex. *Venter* of ♂ with ventrite 5 broadly and very shallowly impressed in the middle.

Length 6.0–8.5 mm., *breadth* 2.0–3.3 mm.

KENYA: Nairobi, 1 ♂, 4 ♀, iv. 1924, and Ngong, 9 ♂, 25 ♀, v. 1944 (*Dr. V. G. L. van. Someren* type); Ruiru, 1 ♀, on Kikuyu grass, vi. 1932 (*Dr. H. C. James*).

EREMNINÆ.

AFRODOLIUS, gen. nov.

Head with the frons very broad, its width more than twice the length of an eye, convex transversely; eyes slightly convex. *Rostrum* very broad, broader than long, about equally wide at base and apex with the sides shallowly sinuate; epistome extending behind the antennæ, its carinate margin forming a sharp acute angle; oral aperture very oblique, much longer than the lower surface of the rostrum, which is not parallel with the upper surface; mentum with four setæ. *Antennæ* not very long, setose; scape gradually and only slightly clavate; funicle with joint 2 not longer than 1, the distal joints longer than broad, but 7 shorter than the basal joint of the club. *Prothorax* transverse, subtruncate at base, the postocular lobes absent or obsolescent, but with distinct vibrissæ. *Scutellum* distinct. *Elytra* rather narrow at the oblique shoulders, widest behind middle. *Wings*

reduced, not functional. *Legs* with a small sharp femoral tooth; corbels of hind tibiae entirely open.

Genotype. *Afrodolius mutans*, sp. n.

This genus belongs to the Cyphicerini and was, unfortunately, overlooked in my revision of the tribe. In my key to the genera having four setae on the mentum (Ann. & Mag. N. H. (11) xi. 1944, p. 77) it runs down to the Indian genus *Doliophron* Mshl., which differs in having fully-developed wings, further, the frons is narrower, being less than twice the length of an eye, and the eyes are more dorsal: the antennae are much longer and more slender, joint 7 being much longer than the basal joint of the club, and the dorsal and ventral surfaces of the rostrum are parallel.

Afrodolius mutans, sp. n.

♂♀. Derm black, with dense pale coppery scaling (typical), the alternate intervals on the elytra being often slightly paler, or the scales may be uniformly pale greenish, or more rarely pearly grey; pronotum with three ill-defined darker stripes.

Rostrum very broad, its sides continuous with those of the head, a little broader than long, nearly as wide at apex as at base, with the sides shallowly sinuate; the dorsal area much narrower than the frons, almost flat, with a fine low median carina, the dorso-lateral carinae parallel in the basal half and curving outwards apically. *Prothorax* strongly transverse (3:5), parallel-sided in the apical half and somewhat narrowed basally; dorsum even, coarsely punctate, but the punctures hardly visible through the scaling. Elytra of ♂ somewhat narrower than those of ♀ but also dilated behind the middle, jointly rounded at apex; the striae with fairly strong punctures that are partly obscured by scaling and diminish behind; the broad intervals slightly convex and with a row of short broad suberect white setae, the scales small, round or shortly ovate. *Legs* black, with dense coppery or greenish scales.

Length 3.5–5.5 mm., breadth 1.2–2.1 mm.

KENYA: Migori Valley, 4,200 ft., S. Kavirondo, 1 ♀, v. 1911 (*Dr. S. A. Neave*); Upper Nzoia R., 5,100–5,400 ft., N. Kavirondo, 1 ♂, 2 ♀, vi. 1911 (*S. A. N.*); Nairobi, 2 ♂, iii. 1906 (*W. L. Slater*); E. Lake Baringo, 1 ♀, 1907 (*R. Ford*); Nairobi, 2 ♂, 2 ♀, iv. 1924, and Ngong, 3 ♂, 4 ♀, v.

1944 (Dr. V. G. L. van Someren); Ngong, 1 ♀, v. 1926 (A. F. J. Gedye), Muhoroni, 1 ♂, 1 ♀, iii. 1936 (H. J. A. Turner). N.-W. RHODESIA: Namwala, 3 ♂, 10 ♀, iii. 1913; Mwengwa, 2 ♀, iv. 1914 (H. C. Dollman). S. RHODESIA: Salisbury, 4,800 ft., 2 ♂, 2 ♀, i. 1894, 1 ♀, i. 1898, 1 ♂, 1 ♀, iv. 1899, 3 ♂, 1 ♀, iii. 1902, 1 ♂, i. 1906 (type) (G. A. K. Marshall).

This is the only Cyphicerine species that is known from south of Kenya. It might be mistaken for one of the broad-headed species of *Mylocerus*, but can be readily distinguished by the presence of postocular vibrissæ on the prothorax. Single specimens of two other species of this genus are known from Senegal and N. Nigeria, respectively.

BRACHYCERINÆ.

Synthocus nigeriensis, sp. n.

♂♀. Derm black, with dense small upright black to blackish-brown scales; head with variable markings of pale scales, rostrum entirely pale; prothorax with the lateral margins and part of the basal area fulvous to red, the propleuræ entirely white or grey, except for a variable black spot at the base on a level with the eye; elytra entirely black above except for a dense fringe of pale scales along the base, the deflexed sides entirely whitish except for an intrusion of black scales in the middle of the upper edge and one or two black spots along the lateral margin, the posterior declivity with a variable white patch on its apical two-thirds; underside dark brown, with the sides of the sternum whitish, venter with a median and lateral row of whitish spots.

Head with deep rugose punctation and a high costa above each eye. *Rostrum* widening from base to apex, with a broad constriction at the insertion of the antennæ, with coarse rugose punctation. *Prothorax* as long as broad, moderately rounded laterally, obtusely angulate in the middle, broadly constricted near the apex and distinctly narrowed at the base; dorsum rugosely punctate on the basal half and there with a broad median sulcus, the lateral margins broadly and obtusely costate and enclosing on the apical half a broad deep transverse depression. *Elytra* subquadrate, with the shoulders strongly projecting laterally, forming a broadly rounded prominence composed of agglomerated tubercles, the sides deeply sinuate and projecting laterally again at the top of

the declivity, which is absolutely perpendicular; dorsum almost flat, with somewhat irregular rows of large shallow punctures, interval 1 slightly raised and even throughout, 3 with a short broad obtuse oblique costa at the base, the other dorsal intervals very narrow, irregular and uneven; the lateral edge formed in front by interval 6 and in the posterior half by 5, which curves strongly outwards and conceals 6 from above, the posterior lateral projection formed by an aggregation of convex or conical tubercles, the lateral areas appearing almost vertical from above; the top of the vertical declivity formed by a strong transverse tuberculate ridge which is broadly interrupted at the suture, interval 2 on the declivity with a row of small conical tubercles and a row of larger ones on 6, which forms the lateral margin of the declivity. *Legs* mottled with brown and whitish scales, and with sparse short erect setæ.

Length 8-10 mm., breadth 5.5-7.0 mm.

N. NIGERIA: Azare, 3 ♂, 3 ♀, 1926 (*Dr. Ll. Lloyd*—type); Kano, 1 ♂, 1 ♀, viii. 1944 (*R. K. J. Gascoigne*).

Belongs to the group of *S. truncatus* Boh., which occurs in the same places and differs in that the sides of the prothorax are not costate and the lateral angulation is caused by an obtuse tubercle; on the elytra the margin of the flat dorsal area is formed by interval 4, which is quite straight behind, and the lateral area beyond it slopes outwards.

But the present species is more nearly related to *S. sinuatus* Mshl., which occurs in the Rhodesias and differs as follows:—the sides of the pronotum are black, and the propleuræ are black on the upper and white on the lower half; the prothorax is rounded and not angulate laterally, on the elytra the dorsal area is bounded laterally by interval 4, which curves outwards similarly behind, but the lateral areas beyond it slope as in *truncatus*, and the posterior prominence is formed of flattened tubercles.

ERRHININÆ.

Echinocnemus glabrirostris, sp. n.

♂♀. Derm red-brown to piceous, fairly densely and uniformly clothed with brownish-grey scales that are not entirely contiguous, the rostrum and upper surface of

the head almost completely bare, shiny; underside with dense grey scales.

Head with strong close punctures, the frons narrower than the base of the rostrum, not impressed. *Rostrum* slightly longer than the pronotum, stout, strongly curved, narrowing for a short distance from the base, then parallel-sided to the antennæ and widening again to the apex, set with close strong punctures (finer and sparser in ♀) that become larger and subconfluent laterally, with a broad median impunctate stripe on the apical third which is flattened dorsally, scrobes passing obliquely beneath the base of the rostrum. *Antennæ* red-brown; funicle with joint 1 longer than 2+3, 4-6 subequal and as long as broad, 7 longer than 6. *Prothorax* transverse (10:13), strongly rounded laterally, widest at a little before the middle, constricted at apex, which is narrower than the truncate base, the postocular lobes slight and fimbriate; dorsum almost flat longitudinally, with dense small punctures, which become larger and subreticulate laterally, with a short impunctate median line; the scales rather longer and transverse on the disk, shorter and denser laterally. *Elytra* parallel from the obtusely rounded shoulders to beyond the middle, shallowly constricted subapically, and truncate at the base, the well-impressed striae with separated punctures that are visible through the scaling, the intervals broad, feebly convex, with small short scales and minute inconspicuous appressed setæ. *Legs* red brown, with small pointed non-contiguous scales, the apices of which are more or less raised, the tarsi paler; tibiae strongly denticulate and with a fringe of long setæ on the lower edge; tarsi with joint 3 much wider than 2. *Venter* of ♂ with a large round deep depression at the base and a large semicircular one on the apical half of ventrite 5.

Length 5-6 mm., breadth 2.1-2.5 mm.

KENYA: Rabai, 4 ♂, 1 ♀. viii. 1937 (*Dr. V. G. L. van Someren*).

Nearly allied to *E. tostus* Mshl., from Portuguese E. Africa, which differs in having the bases of all the femora strongly flattened; the rostrum is shorter, opaque and not flattened at the apex: the punctures on the pronotum are much shallower and confluent.

*RRYNCHINÆ.**Rhamphus senegalensis*, sp. n.

Derm piceous, with short subrecumbent fuscous setæ.

Head rugosely punctate on the vertex, the frontal triangle smooth and almost impunctate; eyes contiguous on their basal half. *Rostrum* reaching the basal margin of the prosternum, shiny and almost impunctate dorsally, with a punctate stria on each side. *Antennæ* flavous, with the club black. *Prothorax* transverse, strongly rounded laterally, widest at one-fourth from the base, with a narrow shallow apical constriction, the base truncate; dorsum with fairly close large shallow punctures and short recumbent fuscous setæ. *Scutellum* bare. *Elytra* obovate, widening from the base to two-thirds, truncate at the base; the rather deep striae with shallow separated punctures, the intervals slightly convex, rugulose, each with a single row of short subrecumbent setæ, which laterally become longer, stouter and more raised, the lateral margin not dilated.

Length 0.9-1.1 mm., *breadth* 0.5-0.6 mm.

SENEGAL: Bambey, 24 specimens, adults feeding on flowers of salads and cowpeas, 1945 (*Dr. J. Risbec*).

Although a good many species of this genus are known to me from southern Africa, only a single species has previously been described from the Ethiopian Region, viz., *R. mimosa* Hust., 1936, from Abyssinia. This differs in being devoid of setæ dorsally, the pronotum is finely and sparsely punctate, and the lateral margins of the elytra are narrowly expanded.

The feeding habit of this species seems to be unusual, as the genus is generally arboreal; the European species feed on *Ulmus* and *Crataegus*. I know five African species that live on *Acacia* and one on *Brachystegia*, and several Australian species have also been recorded from *Acacia*.

*ISORRHYNCHINÆ.**Lobotrachelus bidentipes*, sp. n.

♂♀. Derm black, with fulvous and white markings; rostrum of ♂ with dense white scaling and a narrow yellow median line, that of ♀ fulvous with a white patch on each side at the base; prothorax of ♂ entirely or

mostly white laterally and with a diamond-shaped spot of dense white scales on the median basal lobe, two large black spots in the middle of the disk and two more behind them at the base, all these being narrowly surrounded with fulvous; prothorax of ♀ fulvous laterally or with variable white markings, and always with a pair of large dorsal white spots in front of the discal black spots, otherwise as in ♂; elytra in both sexes with a sutural stripe of dense fulvous setiform scales from the base to beyond the middle, a rather sparse basal band of fulvous setæ from stria 2 to the shoulder, about the middle a similar band of mainly white setæ between striae 1 and 7 and a second one close behind it, the apical margin with the derm reddish and with a band of fulvous setæ; venter and metasternum with dense white scales.

Head with dense fulvous scaling, becoming paler laterally; eyes separated by a double row of scales. *Rostrum* curving downwards beyond the antennæ, that of ♂ with a sharp median carina, but the sculpture hidden by dense scaling throughout; that of ♀ more obtusely carinate on the basal half only, which is densely squamose, the apical half sparsely setose and with very fine shallow punctures. *Antennæ* flavous; funicle with joint 1 as long as 2+3, 4 as long as 3, 5-7 as long as broad or slightly transverse. *Prothorax* (including the median lobe) as long as broad, subconical, with the sides straight, dorsum with close shallow subconfluent punctures throughout which are hidden by the dense oblong scales. *Elytra* with deep shallowly punctate striae; the intervals flat, finely rugulose, the spaces between the bands of fulvous and white setæ clothed with black setæ. *Legs* with the femora piceous, the tibiae and tarsi testaceous; anterior pairs of femora with white setiform scales, becoming mixed with fulvous near the apex, the hind pair with denser white scales on the basal third and fulvous elsewhere; front femora with two strong teeth, posterior pairs with a single smaller tooth.

Length 1.6-1.9 mm., breadth 1.0-1.1 mm.

SENEGAL: Bambey, 8 ♂, 10 ♀, adults feeding on flowers of mango, i. 1945 (*Dr. J. Risbec*).

Apart from its striking coloration this insect differs from all the known African species in having two teeth on the front femora,

*BARIDINÆ.**Baris cucurbitæ*, sp. n.

♂♀. Derm uniform dull blue-black, but with middle of the venter shiny.

Head separated from the rostrum by a deep impression, with fine sparse punctures which become larger and denser anteriorly. *Rostrum* of ♂ somewhat longer than the pronotum, strongly curved, parallel-sided from base to antennæ (inserted beyond middle) and very slightly narrower beyond, as high as wide near the base and rapidly narrowing to the apex in lateral view, coarsely and closely punctate nearly to the apex, without dorsal sulci or carinæ, rostrum of ♀ similar, but with the antennæ inserted at middle, the apical half more narrowed dorso-ventrally and with only fine sparse punctures. *Antennæ* black: funicle widening distally, joint 1 as long as 2+4, 2-7 transverse, 7 twice as broad as long and fitting closely to the club. *Prothorax* distinctly transverse (5:7), strongly rounded laterally and narrowing abruptly at the broad apical collar; dorsum moderately convex longitudinally, highest at the base, with fairly close large punctures, each containing a minute appressed black seta, and with an abbreviated smooth median line. *Scutellum* triangular, with the apex pointing forwards, and shallowly punctate. *Elytra* comparatively broad and rather flat, much wider at the obtusely rounded shoulders than the prothorax, gradually narrowing thence posteriorly, broadly and jointly rounded at the apex, with low obtuse posterior calli and no discal impressions; the striae deep and sharp, becoming deeper at the apex, with catenulate punctures; the intervals flat, with a row of large shallow punctures which are often more or less irregularly duplicated near the base and which become gradually transformed behind into elongate granules, each puncture containing a minute appressed black seta, interval 9 being costate on the apical half, and the lateral margin forming a narrower costa at the apex. *Legs* blue-black, with the tarsi red-brown, coarsely punctate, each puncture with a short setiform scale; front coxæ with a small prominent tubercle on the inner face. *Sternum* with a broad shallow prosternal furrow. *Pygidium* only shortly exposed in both sexes and very rugose.

Length 4.5–5.5 mm., breadth 2.5–2.8 mm.

KENYA: Kasigau, 6 ♀, bred from *Cucurbits*, xi. 1938 (Dr. V. G. L. van Someren--type); Stony Athi, 1 ♂, xii. 1940.

Closely allied to the southern *B. atrocerrulea* Boh., which differs in having the prothorax proportionately longer (4:5), with its sides much less strongly rounded and less abruptly constricted at the apex, the punctures rather smaller and denser, without any smooth median line; and the tarsi are black.

COSSONINÆ.

Phlarophagosoma cucurbitæ, sp. n.

♂♀. Derm entirely red-brown, shiny.

Head with the postocular constriction very shallow, the vertex entirely impunctate, the frons with strong separated punctures. Rostrum stout, gently curved, parallel-sided in front of the antennæ (which are inserted at one-fourth from the base in both sexes) and slightly narrower in the basal part, dorsum with fine separated punctures throughout in ♂, those in ♀ finer and sparser. Antennæ with joint 2 of the funicle transverse, much shorter than 1. Prothorax longer than broad, rounded laterally, widest at one-third from the base, constricted at the apex, with the constriction continued shallowly across the disk; dorsum not flattened, with evenly distributed punctures that are mostly separated by more than their own diameters and with a variable smooth median line. Elytra elongate, not wider at the shoulders than the broadest part of the prothorax and very gradually narrowing behind; the rather deep striæ containing strong separated punctures that do not diminish behind, the intervals broader than the striæ, impunctate or with a row of extremely minute punctures, interval 9 forming a slightly projecting flange near the apex.

Length 3.0–3.2 mm., breadth 0.7–0.8 mm.

SENEGAL: Bambey, 9 ♂, 3 ♀, adults feeding on seeds of *Cucurbita*, iv. 1945 (Dr. J. Risbec).

The only other species described so far from continental Africa is *P. lævistriatum* Hust. (Rev. Zool. Bot. Afr. xxvi. 1934, p. 39—*Mimus*), which is a larger insect (4.0–4.5 mm.), having the antennæ inserted in the middle of the rostrum,

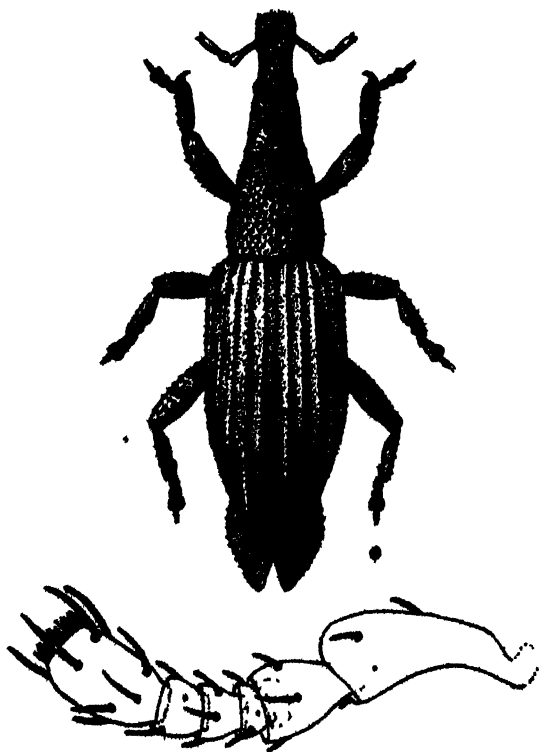
joint 2 of the funicle longer, and the sides of the prothorax much more densely punctate.

Myrmecorrhinus serraticauda, sp. n. (Fig. 1.)

♂♀. Derm dark piceous, opaque.

Head very elongate, longer than broad (10 : 7), widest at base, rapidly narrowing in front, with the sides quite

Fig. 1.



Myrmecorrhinus serraticauda, sp. n.

straight, coarsely reticulately punctate; frons depressed, with an undulating carina on each side, eyes moderately convex. *Rostrum* nearly straight, much longer than broad, somewhat shorter than the head, broader at the base than the frons, parallel-sided to the antennæ, then dilated to the apex; dorsum very rugose, with short

stiff pale erect setæ; scrobes curving strongly downwards in front of the eyes and continued shortly beneath the anterior part of the head, their upper edge being sharply carinate. *Antennæ* honey-brown; joint 1 of the funicle large and cup-shaped, entirely enveloping and concealing joint 2, 2-5 transverse (fig. 1). *Prothorax* longer than broad (7 : 6), widest at the base, gradually narrowing to near the apex, which is broadly and shallowly constricted; dorsum somewhat flattened on the disk, very coarsely and reticulately punctate throughout. *Scutellum* very small, shiny. *Elytra* elongate, parallel from the rounded shoulders to beyond the middle, then gradually narrowing to near the apex, where each elytron is broadly dilated into a flattened plate, which is produced into an obtuse point well beyond the apex, the outer edges of the process being coarsely serrate; dorsum deeply sulcate, with large close punctures, the intervals narrowly carinate, the carinae being somewhat uneven or subgranulate and with a single row of very short scale-like pale recumbent setæ. *Legs* coarsely scabrous, the femora with sharply-pointed granules on the upper surface; tibiae broadly compressed, parallel-sided; tarsi with joint 3 bilobate and pubescent beneath on the apical half only, the basal joints bare.

Length 2.5-4.0 mm., *breadth* 0.7-1.0 mm.

Kenia: Londiani, 2 ♂, 4 ♀, in carton nest of an ant (*Crematogaster*), ix. 1943 (*S. Patrizi*).

This species is provisionally attributed to the genus *Myrmecolixus*, proposed by Wasmann for a species from Madagascar that was also found in a nest of *Crematogaster*. From the description, the latter species has the rostrum parallel-sided and not dilated apically; the intervals on the elytra are flat and bear a row of punctures, and the apical expansions are very small in comparison and not serrate laterally.

I am indebted to Dr. H. E. Hinton for the drawing of the antenna.

This is only the third species of Curculionidæ known to be truly myrmecophilous, and they all occur with the same genus of ants, which suggests that they may feed on the substance of which the carton nests are made.

The other species, *Myrmecolixus braunsi* Wasm., from South Africa, was also referred by its author to the *Consoninae*; but the resemblance is really only superficial.

One of the most constant characters of the Cossoninæ lies in the form of the strongly uncinatæ tibiae; in this respect, as well as on account of the structure of the head and rostrum and the form of the basal process of the venter, *Myrmecolixus* must be excluded from that subfamily. It is a very aberrant insect, but would be much more suitably placed in the Cleoninæ or Hylobiinae, and I should provisionally assign it to the latter.

XLII.—*The Pleistocene Mole of Sardinia.* By DOROTHEA M. A. BATE, British Museum (Natural History).

INTRODUCTION.

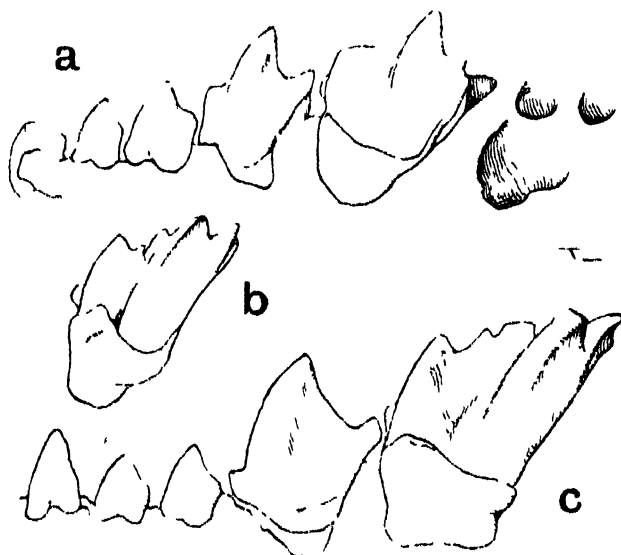
No mole is found living in any of the larger Mediterranean islands at the present day, so far as available records show, nor, with one exception, has any fossil species been discovered. The occurrence of this single exception, the Pleistocene mole of Sardinia has, however, been known for a number of years, having been first recorded by Lydekker (1887), who listed a number of specimens. Nevertheless the species has never been defined or described, therefore it is proposed to give a short description here, based on the above-mentioned specimens, which were discovered by Forsyth Major, and were first to be noticed in print. Dr. Schaub tells me in a letter that a number of specimens are also included in the palaeontological collections of the Natural History Museum of Bâle, but owing to present circumstances it has not been possible to examine these.

Talpa tyrrhenica, sp. n. (Figs. 1–3.)

Diagnosis.—A *Talpa* of small size with robust teeth, probably belonging to the *T. romana* group of moles; about the body size of the Pleistocene *T. chthonia*, and the Recent *T. caeca* from Italy. Snout longer than in *T. chthonia*, lachryma foramina noticeably large, larger than in *T. chthonia*. Premolars stouter, and molars much more massive than in *T. caeca* from Italy. pm^1 to 3 placed close together with roots practically in line, pm^3 the smallest; these teeth comparatively slightly stouter

than in Recent *T. romana*. pm^4 large and robust, obliquely wide anteriorly, its base forming an isosceles triangle, an antero-external basal denticle present, the stout internal root directed backwards. Molars high-crowned and massive; though smaller, their proportions are much as in Recent *T. romana*. Mandible rather short, with condyle directed straight backwards. pm_1 and 4 large, roots of the small pm_2 and 3 placed obliquely. Limb-bones rather shorter and somewhat stouter than

Fig. 1.



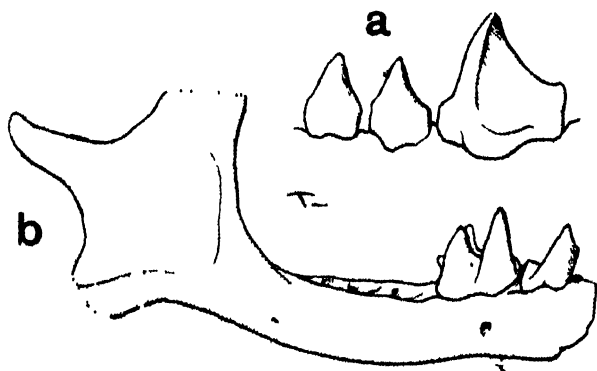
- a. *Talpa tyrrhenica*, sp. n., holotype. B.M. M.3489, pm_1-4 and M^1 in left maxilla, internal view, $\times 10$. Pleistocene, Sardinia.
- b. *T. tyrrhenica*, unworn M^1 . B.M. M.16099, internal view, $\times 10$. *ib. loc.*
- c. *T. romana*, holotype. B.M. 1.1.2.8., left pm_1-4 and M^1 , internal view, $\times 10$.

those of Recent *T. caeca* from Italy. Femur long, with third trochanter situated lower on the shaft of the bone than is usual in Recent *Talpa*.

Holotype.—A left maxilla with pm_1-4 and M^1 . From the Pleistocene bone breccia of Monte San Giovanni, S W. Sardinia (M.3489, fig. 1, a).

Other specimens examined.—Three imperfect mandibular rami, a scapula, eight humeri, five ulnæ, six radii, seven femora and a tibia. These are the specimens, together with the holotype, mentioned by Lydekker (1887, p. 301) under the number M. 3489. This number has been retained for the holotype, and the remainder have been re-registered M.16100–M.16110. Recently a totally unworn M^1 was discovered and extricated from a small piece of matrix which formed part of Forsyth Major's collection from Monte San Giovanni, and which also contained remains of *Nesiotites similis*. This tooth is now registered M.16099, and is shown in fig. 1, b.

Fig. 2.



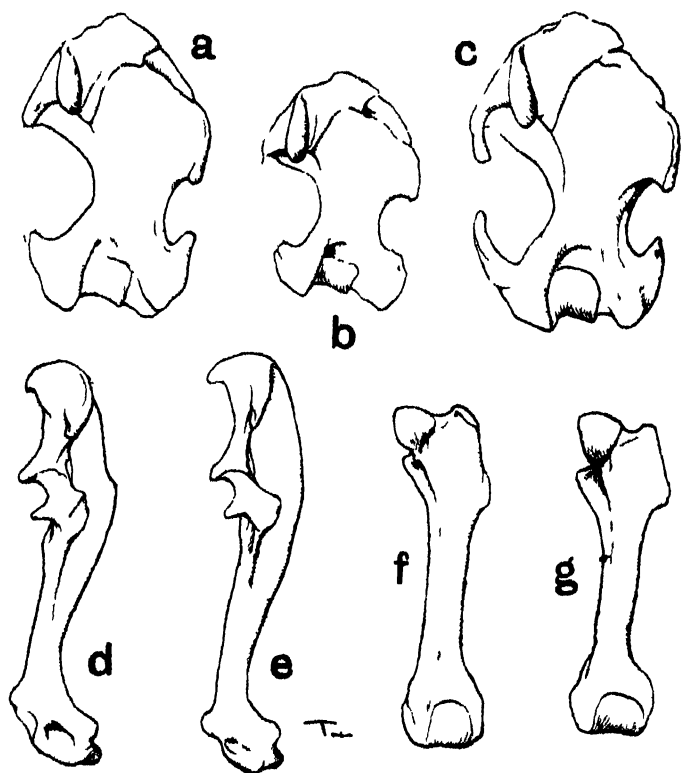
a. *Talpa* sp., left pm2–4. B.M. M.16098, internal view, $\times 10$. Cromer Forest Bed.

b. *T. tyrrhenica*, right mandibular ramus, outer view, $\times 5$. B.M. M.16100. Pleistocene, Sardinia.

Locality and horizon.—Sardinia; Pleistocene. Known from an ossiferous breccia on Monte San Giovanni, a hill which rises to a height of 1000 feet in the neighbourhood of Iglesias in the south-west of the island. Dr. Tobien (1935, p. 26) records the species from a second locality, Dragonera, and this information is probably taken from labels in the Natural History Museum, Bâle. *T. tyrrhenica* has not been found at the well-known bone deposit of Bonaria near Cagliari; on my visit to this site in 1927 a sharp look out for specimens was kept, but without result, although a quantity of remains of *Nesiotites similis*, an associated species, were obtained.

Associated fauna.—Associated with *Nesiotites similis*, *Enhydriactis galictoides*, *Tyrrhenicola henseli*, *Rhagamys orthodon*, and *Prolagus sardus*. Remains of these five

Fig. 3



- a. *Talpa tyrrhenica*, left humerus, posterior aspect, $\times 3$. B.M. M.16102. Pleistocene, Sardinia
 b. *T. minuta*, left humerus, posterior aspect, $\times 3$ B.M. M.5575. Middle Miocene, La Grive St. Alban.
 c. *T. caeca*, left humerus of Recent skeleton, posterior aspect, $\times 3$. B.M. 45.7.22.32. Northern Italy.
 d. *T. tyrrhenica*, left ulna, $\times 6$ M.16104.
 e. *T. caeca*, Recent, left ulna, $\times 6$.
 f. *T. tyrrhenica*, left femur, anterior aspect, $\times 6$ M.16108.
 g. *T. caeca*, Recent, left femur, anterior aspect, $\times 6$

species, as well as of *Talpa tyrrhenica*, were collected from Monte San Giovanni by Forsyth Major, who recorded the locality either in print or on labels with the specimens.

A noteworthy fact which should not be overlooked is that each of these species, other than the mole, represents an extinct genus; this seems to suggest that they form part of an Early Pleistocene assemblage, while the presence of *Tyrrhenicola henseli*, a primitive vole but one having permanently rootless cheek-teeth, indicates a time not earlier than the latest part of this period.

Distribution.—Known only from the Island of Sardinia.

Description and comparisons.—Although no incisors or canines are included among the Sardinian specimens available for study, the presence of four premolars in both the upper and lower jaw suggests that *T. tyrrhenica* should be assigned to the genus *Talpa*. The cheek-teeth are large and robust compared with the small size of the skull and mandible, and this, together with the large size and characteristic shape of pm^4 , prompts the allocation of the fossil species to the *T. romana* group of moles.

Since no skull or skeleton of the small *T. romana stankovici* from the mountains of Serbia (Martino, 1931) was available it has been found convenient, owing to its approximation in size, to use chiefly Recent *T. caeca* from Italy for comparison with the fossil, particularly in the case of limb-bones. It is not, however, considered that the two species are closely related, for the teeth differ greatly, and the limb-bones, though generally similar in size, show a number of small structural differences which denote differences of specialisation and relationship.

Consequent on the rarity and imperfection of the specimens very little is yet known, apart from the teeth, regarding the skull of *T. tyrrhenica*, except that the snout is moderately long and the lachrymal foramina comparatively large. In the holotype (fig. 1, a) the external alveolar length of M^{1-2} is 4.1 mm., and that of pm^{1-4} is 4.5 mm. In Recent *T. romana* these proportions are reversed, the external alveolar length of M^{1-2} being 10.6 mm., as opposed to 9.7 mm. for pm^{1-4} in the holotype. In Recent *T. caeca* and *T. europæa* the length of pm^{1-4} is considerably less than that of M^{1-2} ; it is evident that in Recent species the premolars have a tendency to decrease in size. Comparing the unworn M^1 of *T. tyrrhenica* (fig. 1, b) with the slightly worn corresponding tooth of *T. romana*, it is seen that in the latter the external and posterior borders are noticeably more extended than in the fossil.

In moles the fourth upper premolar is a characteristic and important tooth for diagnostic purposes, and fortunately a well-preserved example is present in the holotype of *T. tyrrhenica* (fig. 1, a). It is robust, closely resembling that of *T. chthonia*, and similar in type to that of *T. romana*. The maximum crown length of the *pm*⁴ of *T. tyrrhenica* is 1.8 mm., and the base of the crown is in the shape of an isosceles triangle, the anterior angle being the shorter, while the external and posterior ones are equal. In Recent *T. romana* the three angles of the tooth are each of different length, the anterior one being considerably the shortest, and the external one the longest. In Recent *T. europæa* the *pm*⁴ is very distinct in shape from the above. In specimens from Britain and other parts of western Europe, chiefly France and Germany, this tooth is seen to be smaller and weaker, and it never has more than a very small antero-external tubercle. A cross-section of the base of the crown shows it to be almost a slender ovoid in outline, the lack of breadth is chiefly due to the almost flat internal flank. It is of great interest that an example of this tooth in a fragment of a left maxilla from the Forest Bed of south-east England (Brit. Mus. M. 16098) proves to be of similar type to that of Recent *T. europæa*, although the species is no doubt distinct from the Recent one, as suggested by Barrett-Hamilton (1911, ii. p. 8). Newton (1882, p. 95) does not refer to any parts of skulls or upper teeth of moles from the Forest Bed, nor are any mentioned in the 'List' of the figured specimens in the Norwich Castle Museum (Leney, 1902); it seems, therefore, desirable to figure the specimen now found in the British Museum Collection (fig. 2, a). A number of Forest Bed limb bones, also in the British Museum Collection, which vary greatly in size, suggest the presence of two forms, possibly identical with species described from Continental European Cromerian deposits.

Compared with the mandible of Recent *T. caeca* and *T. occidentalis*, it is found that the length of the fossil ramus (fig. 2, b) is substantially less than that of the Recent species, although the teeth of *T. tyrrhenica* are considerably more robust. The larger size of the fossil molars is occasioned by their great breadth, for the length of the lower tooth-row is actually less in the fossil than it is in Recent *T. caeca*. The alveolar length of

pm_1-M_2 in a worn specimen of *T. tyrrhenica* is 9.8 mm., compared with 10.3 mm. in *T. caeca*

In the skeleton of Recent *T. caeca* from Italy which I have for comparison, with the exception of the femur, the limb-bones are slightly longer, and generally more slender than those of *T. tyrrhenica*. Among the Sardinian fossil limb-bones preserved in the British Museum the maximum length of the humerus is 12.2 mm., of the ulna 16.5 mm., the radius 10.2 mm., and the femur 13.5 mm. The scapula has a length of 18.8 mm.

Even as far back as in Middle Miocene times the humerus of some moles (i. e. *T. minuta*, fig. 3, b), had become a highly specialised bone with immense development of the extremities, especially proximally, to provide room for the attachment of the greatly enlarged muscles of the powerful digging fore-limb. This increase of the extremities is accompanied by a corresponding reduction in the length of the shaft of the bone. The geologically early specialisation of the humerus for a special function has meant that in succeeding times, except in detail, there has generally been only slight alteration in the shape of this bone, since its function has remained unchanged. Therefore this bone is not of particular value in supplying diagnostic specific characters in moles and it is unfortunate that it should be the one most easily preserved and most generally collected. In view, however, of Dr. Passermard's rather misleading remarks (1925, p. 348) suggesting that the primitive character of the humerus of *T. tyrrhenica* allied it to the Miocene, rather than to Recent, forms it has been thought advisable to give a drawing of the humerus of the Sardinian species, together with those of Recent *T. caeca* and of *T. minuta* from La Grive St. Alban (fig. 3, a-c). It will be seen that there is not a great deal of difference between the three bones, though it may be noted that the proximal tuberosity articulating with the scapula is intermediate in position in *T. tyrrhenica*.

There are six examples of the radius from Sardinia, and these are all slightly shorter than this bone of Recent *T. caeca* with which they have been compared. The shaft is of much the same width in the two species, but both the proximal and distal articulating surfaces are distinctly narrower from side to side in the fossil, and this seems to suggest a slightly narrower hand than that of the

Recent species. The ulna of *T. tyrrhenica* (fig. 3, d) is slightly shorter than that of Recent *T. caeca* (fig. 3, e), with a shaft decidedly stouter, particularly in its distal portion. The still shorter ulna, 15.3 mm., of *T. chthonia* resembles that of the Sardinian species in the thickness of its shaft.

Five femora of *T. tyrrhenica* are included in the collection, and one of these is shown with a femur of Recent *T. caeca* in fig. 3, f, g. It is slightly longer, 13.5 mm., than the Recent bone, 13.1 mm., but perhaps the most striking difference is that in the fossil the third trochanter occupies a considerably lower position on the shaft of the bone than it does in *T. caeca*, and also in *T. romana*, the lesser trochanter is, on the contrary, higher in position. The shaft of the fossil femur is wide and flat, and the external condyle is less salient than it is in the Recent species. The tibia of *T. tyrrhenica* is represented by a single specimen consisting of the proximal two-thirds of the bone. Except for a stouter shaft this resembles in general size the tibia of Recent *T. caeca*, but it can be at once distinguished by the much lower position on the shaft of the distal junction with the fibula. This low position of the union of the two bones is also seen in *T. romana*, and differs from the condition found in *T. europæa*.

Relationships.—Recently a close study was made of the fossil shrew, *Nesiotites similis*, whose remains are associated with those of *Talpa tyrrhenica* in the bone breccia at Monte San Giovanni in south-west Sardinia. As a result *N. similis* was found to be most closely related to the Recent genus (*Himarrogale*, which inhabits parts of middle and far-eastern Asia (Bate, 1945). This makes it somewhat surprising that the fossil mole, on the other hand, proves to be nearly allied to the south European *T. romana* group. This contrast, however, only serves to emphasize the extraordinary diversity of the component elements which are embraced in the Pleistocene mammal faunas of the Mediterranean islands.

The European moles of the present day fall into three sections: firstly, the *Talpa europæa* group of north temperate and central Europe. It does not appear to be known how far east the range of this group extends, but in south central and eastern Asia it is replaced by other

genera such as *Scaptochirus* (see Thomas, 1910), *Parascaptor*, from eastern Bengal, and *Euroscaptor* which ranges from the eastern Himalayas to southern Annam, thence north to eastern Tibet and western China (Miller, 1940). To these may be added the recently-described genus *Eoscalops*, and subgenus *Asioscalops* (Stroganov, 1941). Milne Edwards (1884) described a mole from the borders of Asia Minor and Syria which he tentatively referred to the genus *Scaptochirus* on account of its dental formula, though its delicate skull and the small size of its fourth upper premolar suggest other affinities. I have found no further reference to this species, and its description confirms the belief that much still remains to be learnt regarding this as well as other Recent moles.

The second European group is that of *T. caeca*, which is generally rather smaller than *T. europæu*, and is found in the northern Mediterranean region from the southern half of the Iberian Peninsula on the west to Asia Minor on the east, but excluding the Mediterranean islands. It is one of this group, *T. c. occidentalis*, which occurs in Andalucia, and this appears to be the southerly limit of distribution of Recent moles in Europe. This is, if anything, a little further south than the Sardinian, type-locality of the fossil *T. tyrrhenica*. So far as climatic and ecological conditions are concerned, there seems to be nothing to prevent moles from inhabiting parts of either Corsica or Sardinia at the present day; their absence must be accounted for by some former condition, probably an adverse climatic phase, followed by isolation.

The third European group of moles, in which the Sardinian fossil is included, is that of the very distinct *T. romana*, which was recognised much later than the above, Oldfield Thomas first describing specimens from near Rome in 1902. Since then Dr. Altobello (1920, p. 32) has recorded a subspecies, *T. r. major*, from the Abruzzi, central Italy, while more recently *T. r. stankovici* was discovered at an altitude of 1000 metres in the Margarevo Mountains, southern Serbia. This race Dr. Martino (1931) described as of small size with very robust teeth, and he suggested that it was a relic form. He further assumed that the small size of this mole is due to life conditions in rocky granite mountains, but the fossil record makes it seem more likely that its small size is normal for its group

and that it may be a survival not differing greatly from the Pleistocene moles represented by *T. tyrrhenica* and *T. chthonia*. *T. romana* is certainly more specialized than either of these extinct species; this is shown not only by its large size, but also by the comparative reduction of the three anterior upper premolars, and by the wide-spread crowns of the upper molars. The possibility should not be overlooked that *T. r. stancovici* may prove to be identical with the small mole from Hercegovina described by Dr. Bolkay (1925) as *T. hercegovinensis*.

Turning briefly to the record of the Pleistocene moles of Europe and the Mediterranean area, the only species that can as yet be claimed to be related to *T. tyrrhenica* is *T. chthonia* from Palestine (Bate, 1937), already referred to. This species was associated with an Upper Acheulean Industry in Level F of Tabun Cave, in which all the animals specifically determined represent extinct species. So far the presence of only two extinct genera has been recognized (Bate, 1943), and this seems to suggest a slightly later geological horizon than that in which *T. tyrrhenica* lived. A few remains of a small mole associated with a Mousterian Industry have been obtained from Gibraltar; this may prove to belong to the *T. caeca* group, but the specimens at present known are not sufficiently complete for specific determination. As already noted remains of moles are known from the Forest Bed series of Britain, where specimens have also been collected from later deposits, but all await a more critical and intensive study than they have as yet received.

Fabiani (1919) has recorded Quaternary mole remains from northern Italy, while Woldrich (1893) described a very large mole, *Talpa magna*, as well as a very small species, on the validity of which doubt has been cast (Wettstein, 1938), from what is probably a late Pleistocene cave in Austria. *T. magna* has also been recorded from the upper level of a cave in Germany (Wettstein, 1938, p. 533). Dr. Kormos (1930) has described three species of moles from the early Pleistocene of Hungary: *T. præglacialis*, about the size of Recent *T. europæa*, *T. gracilis*, a tiny species inferior in size to *T. tyrrhenica*, and the very large *T. episcopalis*. This last is known only from a few limb-bones, and Dr. Kormos (1930, p. 240) thought it possible that it might be found eventually to belong to the

genus *Mogera*. Dr. Kretzoi (1938, p. 91) suggests that not only are *T. præglacialis* Kormos and *T. europæa* var. *major* Freudentberg from the Hundsheim, Austria, the same species, but that both should be known under the name *T. fossilis*, given to specimens from the early Pleistocene of Hungary by Petényi (1864). This may prove to be correct, but the discovery and study of more complete remains than hitherto available will be necessary to decide the question. Dr. Kretzoi has also suggested that the tiny *T. gracilis* is identical with *T. europæa minor* Freudentberg (1914), and that these may prove to belong to the genus *Scapanulus* (Thomas, 1912). The fossil species is represented by an imperfect mandibular ramus in the British Museum Collection (M.14017); it is not possible to discover the original number of the teeth, but the M_1 and pm_4 are present, and neither resemble the teeth of *S. oweni*, the pm_4 being entirely different in shape. It is probable that this small fossil form represents an extinct genus. Fragmentary remains of *T. præglacialis* Kormos and *T. gracilis* Kormos have been recorded from Cromerian cave deposits in Germany (Brunner, 1933, Heller, 1933 and 1936), and the latter species has also been found in Dalmatia (Kormos, 1931).

Almost nothing is known of fossil moles from Asia, except that remains were found in some number at Loc. 3 of Choukoutien Cave near Peking. These were first described as representing an extinct species, *Scaptochirus primitivus* (Zdansky, 1928). Subsequently Dr. C. C. Young (1934) and Dr. Pei (1936) have suggested that this form is identical with the Recent *S. moschatus*, but, considering the geological age of the deposit, this seems unlikely and definite identification must await the discovery of more complete specimens.

Historical.—When a study of the remains of the Sardinian Pleistocene mole in the British Museum Collection was begun I expected to refer to the species as *Talpa tyrrhenica* Major, under which title it has been listed by a number of authors since 1887. To my regret this course has proved to be impossible, though I have retained the specific name already in use. To make the matter clear a brief recital of the history of the name is necessary. Forsyth Major seems to have been the first to discover remains of a mole in Sardinia, and recognizing that the

specimens represented an undescribed species he wrote the name *Talpa tyrrhenica* on various small labels accompanying the specimens, but he never published any description.

In 1886 the British Museum acquired a collection of mammalian remains from Major, and this included a number representing the Sardinian Pleistocene Mole. These were mentioned by Lydekker (1887, p. 300) in the supplement to Part V. of the 'Catalogue of the Fossil Mammalia in the British Museum (Natural History)' under the heading *Talpa tyrrhenica* Forsyth Major. A footnote explains that the specimens were sent to the Museum with this unpublished name attached to them. A brief list is given of items from Monte San Giovanni, under the registered number M.3489; unfortunately, not a single line of description accompanies this list, with the inevitable result that "*Talpa tyrrhenica* Major" is a nomen nudum.

In 1925 Dr. Passemard published a short note on Pleistocene mammals found by Major in Corsica and Sardinia. Among these he includes "*Talpa tyrrhenica* (Major)" from Sardinia, which he says is characterized by the humerus being less specialized than that of the Recent mole, which links it with Miocene forms. The author gives no indication as to the meaning he applies to this term; so once again this name is unaccompanied by any valid description. I have consulted Dr. K. Jordan, F.R.S., on this point, and he tells me that according to the rules of zoological nomenclature the phrase "less specialized" has no descriptive significance.

In 1929 Professor Vaufreÿ briefly repeats Dr. Passemard's remark that *T. tyrrhenica* is related to the Miocene moles owing to its less specialized humerus, but he advances no evidence in support of this assertion. Dr. Tobien (1935) refers to the Sardinian Pleistocene mole as *T. tyrrhenica* Major, but gives no description, merely including the name in lists of species from two localities in the island, one the type-locality.

SUMMARY.

The subject of this note, *Talpa tyrrhenica*, is the only fossil mole yet known from any of the Mediterranean islands. Its remains were discovered in a Sardinian

Pleistocene deposit by Forsyth Major probably soon after 1880, and part of his collection forms the basis of the present description. No description or diagnosis of the species has been published hitherto, although the name, known from manuscript labels, has been included in a number of printed lists.

A close study of these Sardinian remains shows that *T. tyrrhenica* is allied to *T. chthoniu* from the Pleistocene (Acheulian) of Palestine, and should be included in the *T. romana* group of moles. The Sardinian species is less specialized than Recent forms, this being shown in its short stout limbs, in its hand being probably narrower, its compact molars and robust premolars.

All the five species known to be associated with *T. tyrrhenica* represent extinct genera, and these seem to suggest a dating in the latter part of Early Pleistocene times.

I am very grateful to Mr. Terzi for his beautiful drawings which accompany this note, more especially for the highly magnified figures of the teeth, which should prove of great value for comparative purposes.

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XLIII.—On the Systematic Position of a Fish, *Microcanthus strigatus* (C. & V.). By A. FRASER-BRUNNER (from the Department of Zoology, British Museum (Natural History)).

MICROCANTHUS STRIGATUS (Cuvier and Valenciennes) is a small fish of the western Pacific, having the general shape, when adult, of certain members of the Chætodontidæ, but resembling them very little in other respects. Nevertheless, it has been included in that family without exception from the time when it was first described, in 1831, as *Chætodon strigatus*.

In this fish, the gill-membranes are united and free from the isthmus, whereas in all the Chætodontidæ and their immediate relatives the gill-membranes are joined to the isthmus at least narrowly. This fact has been observed by a number of authors, but the affinities of *Microcanthus* have never been questioned, and the definition of the family has been rendered ambiguous on this point as a result. For example, when characterising the family, Regan found it necessary to state: "Gill-membranes sometimes united, but free from the isthmus, more often narrowly attached to the isthmus."

Other differences meet the eye upon even a cursory examination. The so-called "scaly sheath" of the spinous dorsal in the Chætodontidæ is not a true sheath, but a continuation of the scaly integument upon the fin, to which it is closely attached. In *Microcanthus*, however, a true scaly sheath is present at the base of the spinous dorsal, which moves freely within it. Further, *Microcanthus* has a bi-lobed caudal fin, unlike that possessed by any of the true Chætodontidæ wherein emargination of this fin is acquired by growth of some of the rays.

Fowler and Bean have figured a specimen of only about 18 mm long, in which the emarginate caudal fin is quite typically developed. And it is worth noting that a true Chætodont of this size would probably retain traces of the "*Tholichthys*" stage, whereas the young *Microcanthus* is reminiscent of a small *Terapon*.

These considerations have led me to make a partial dissection of a specimen of this fish, and the results confirm my suspicion that it is not a Chætodont.

The family Chætodontidæ is distinguished, even from near relatives like Scatophagidæ and Ephippidæ, parti-

cularly by the attachment of the ribs, which are borne, not on parapophyses, but on transverse processes to which they are very firmly attached by their expanded proximal

Fig. 1



Microcanthus strigatus (C & V.).

A. Adult, 95 mm., Hong Kong ; B Young, 30 mm., Western Australia.

ends. There are two subfamilies, Pomacanthinae and Chaetodontinae. Although in some respects specialised, the Pomacanthinae seem to me to be fundamentally the more primitive ; they are distinguished mainly by the frontals forming a concavity between the orbits, the

Fig. 2.

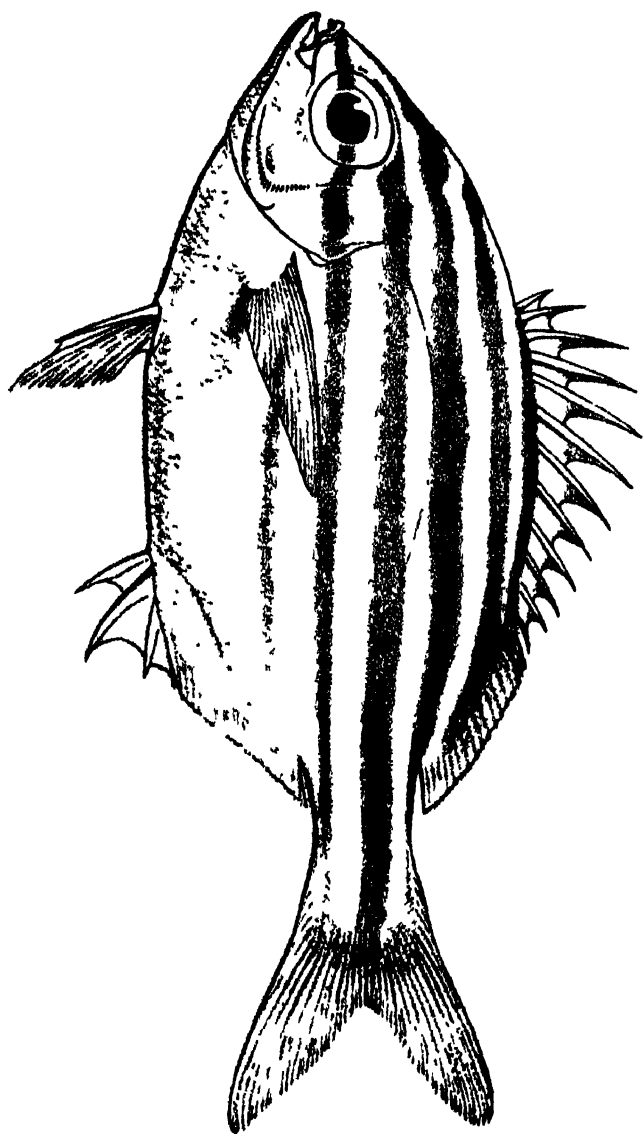
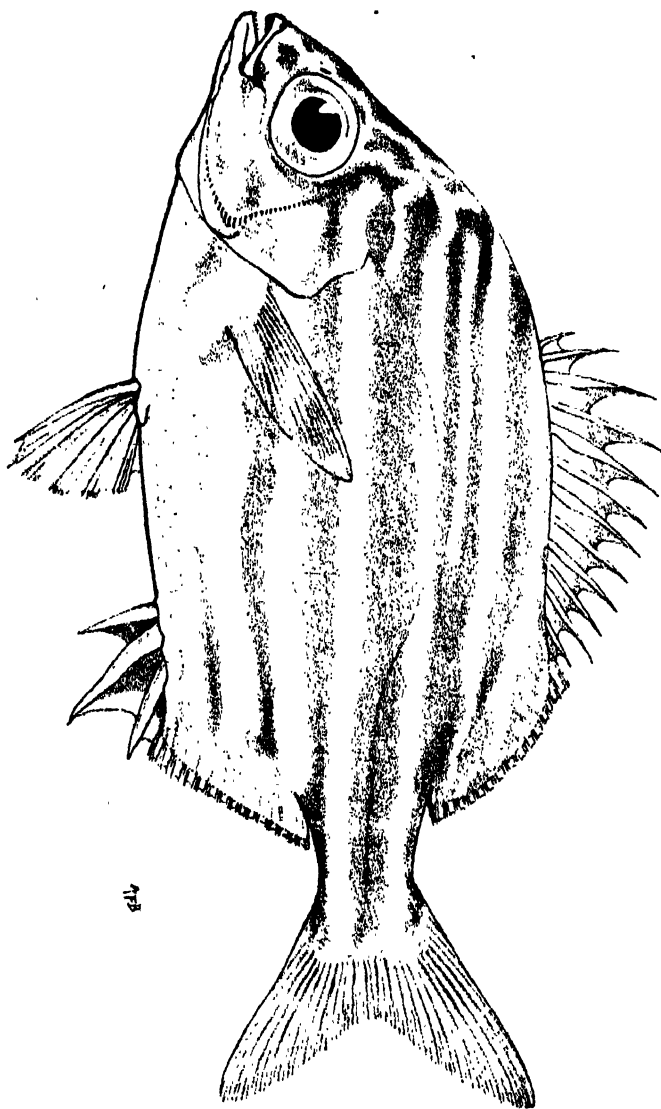
*Atypichthys strigatus* (Günther), 116 mm., Port Jackson

Fig. 3.



Atypichthys latus McCulloch and Waite, 160 mm., Raoul Is.

presence of a strong spine at the angle of the preoperculum, the absence of a pelvic axillary process, the distal portions of the ribs normally formed, and a forward ventral expansion of the first interhæmal bone. They need not further concern us here.

The subfamily Chætodontinæ, to which *Microcanthus* has been supposed to belong, besides lacking a preopercular spine and possessing a well-developed axillary process, has the distal portion of the ribs much expanded antero-posteriorly, so that their edges are almost in contact, forming a rigid cuirass protecting the abdominal organs. This is no doubt associated with their very compressed form, the *lateralis* muscles being exceedingly thin in the abdominal region. (A degree of expansion is to be seen also in the ribs of *Drepane*, which is similarly compressed, but differs in other respects.)

Examination of *Microcanthus* shows its ribs to be quite normally formed, slender, with even the proximal ends scarcely expanded, and attached directly to the centra above and behind parapophyses, which are feebly developed: there are no transverse processes on the pre-caudal vertebrae. Further, parietal crests are developed in *Microcanthus*, whereas they are never present in the Chætodontidæ.

There seems little doubt, therefore, that the real affinities of *Microcanthus* lie with the Scorpididæ, its nearest relatives being evidently *Atypichthys* and *Neatypus*.

Indeed, the only character of significance by which *Microcanthus* can be differentiated from *Atypichthys* is the absence of vomerine teeth. *Neatypus* also is devoid of teeth on the vomer, but it is separable from both the preceding by the form of the teeth in the jaws, which are trilobate. In other respects all three are closely similar, and all are inhabitants of the Australian region.

It is perhaps illustrative of the close similarity between *Microcanthus* and *Atypichthys* to state that amongst the British Museum material I have found three small specimens from Champion Bay, Western Australia (du Bouley), labelled *Atypichthys strigatus* by Günther, which are, in fact, *Microcanthus strigatus*. They are nearly as small as the one figured by Fowler and Bean and agree with it in all essentials. There is a slight change of pattern

during growth, a dark band from opercle across breast being lost with age.

Microcanthus strigatus ranges northward from Australia to Japan and Hawaii. There is some individual variation in addition to the changes due to growth, and several nominal species have been based upon minor differences in pattern; it is doubtful whether these will prove to be tenable even as local varieties, for the two examples figured here agree well with *M. hawaiiensis* Fowler, although the small one is from Western Australia and the larger one from Hong Kong.

There are two species of *Atypichthys*. *A. strigatus* was first described by Günther; later, *A. latus* was described and well figured by McCulloch and Waite. But I find that Günther's material included both species, his "fine male specimen" from Raoul Id. being *A. latus*. His description seems to be based very largely on this latter fish, the only spirit specimen he had at the time; but as he gives the number of dorsal spines as 11, it will avoid much confusion to accept his specimen "*a*," adult skin, from the Swan River, as the type of the species, and refer his spirit specimen to *A. latus*, which has a deeper body, 12 dorsal spines, and a different pattern.

Whitley, however, has designated the type-locality of *A. strigatus* (Günther) as Raoul Island, thus reducing *A. latus* McCulloch and Waite to a synonym, and has proposed the name *A. mado* for the form thus left nameless. But this unnecessary complication may be corrected by regarding McCulloch and Waite as the first revisers, since they distinctly stated that they obtained both forms at Lord Howe Island and made comparisons, clearly accepting the name *A. strigatus* (Günther) for a fish specifically distinct from their *A. latus*; this seems to me to be an implicit designation quite as strong as the choice of a type-locality. In any case, it is very much open to question whether the designation of a type-locality can be accepted as equivalent to fixing a lectotype. The first definite selection of a type is that stated above, namely, Günther's specimen "*a*." Adult; skin. Swan River. Voyage of H.M.S. Fly."

A. strigatus is the common species of the Australian coast; the British Museum collection now contains a number of specimens, and those from Western Australia

do not differ in any important respect from those of the eastern coast. *A. latus* appears to be an island form, though as mentioned above, both have been taken at Lord Howe Island.

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XI.IV.—*Descriptions and Records of Bees.*—CXCIX.

By T. D. A. COCKERELL, University of Colorado.

Halictus clavigerellus, sp. n.

♂.—Length about 5.4 mm., anterior wing 4 mm.; black, slender, with a long subclavate abdomen, which is without hair-bands or spots; head approximately circular, seen from in front, orbits converging below; clypeus not much produced, light yellow, with two large black spots near base; labrum yellow; mandibles with a yellow mark; sides of face and front with white hair; antennæ very long, reaching end of thorax, flagellum red beneath; mesonotum and scutellum polished; postscutellum not covered with tomentum; area of metathorax coarsely plicate, shining between the plicæ; tubercles pale yellowish tegulæ very small, pale, dark at base; wings clear hyaline, stigma sepia brown; second submarginal cell receiving recurrent nervure near apical corner; third submarginal cell very short; knees, tibiæ in parts, and the tarsi light yellow; the front tibiæ have no distinct dark mark, the middle tibiæ have a conspicuous mark, and the hind tibiæ are largely black.

Gold Coast: Aburi, 1912–13 (*W. H. Patterson*). This is the type, but another is from Kampala, Uganda, Nov. 10–19, 1917 (*C. C. Gowdey*). From the style of the mount and the printing of the labels, it appears that they were

mounted at the same time, and it seems permissible to suspect that one of the localities is erroneous.

This is a unique species, known from other small species by the lack of green colour and the peculiar abdomen. *H. epichlorus* Ckll., which is similar in some respects, has the male clypeus all black.

Halictus kabetiellus, sp. n.

♀.—Length about 5 mm.; head bluish green, thorax more brassy green, abdomen black suffused with green, without hair-bands or spots; face and front shining, the supraclypeal area conspicuously polished, clypeus with the upper part green, the lower part black; face practically devoid of hair; mandibles black; antennæ black, the flagellum obscurely reddish beneath; mesonotum and scutellum polished, the scutellum not grooved in middle; postscutellum not covered with hair; area of metathorax rather large, dull, the hind margin shining; tegulæ black; wings greyish hyaline, stigma large, pale, brown, nervures pale; outer nervures not weakened; second submarginal cell broadened below; first recurrent nervure interstitial; legs black.

British E. Africa, Kabete, Sept. 17, 1918 (*T. J. Anderson*).

Halictus wilkinsoni, sp. n.

♀.—Length about 5.5 mm.; head and thorax brassy green, mandibles, apical margin of clypeus, and antennæ black; clypeus and supraclypeal area shining, front dull; face not hairy; mesonotum and scutellum shining; postscutellum not covered with tomentum; area of metathorax very large, entirely dull, the middle of hind margin shining; tegulæ black; wings dusky; stigma brown; nervures brown; second submarginal cell receiving recurrent nervure some distance before end; legs black; abdomen robust, black, the third tergite very faintly greenish; no hair-bands or spots.

Kenya: Kakusi, 1921 (*H. Wilkinson*).

The two species described above belong to a group of six, forming a special section of the genus. They may be separated as follows:—

- | | |
|---|----|
| Abdomen black (with obscure traces of green
in <i>H. wilkinsoni</i>)..... | 1. |
| Abdomen green | 3. |

1. Front dull; face brassy green; mesonotum lineolate, with widely separated punctures; area of metathorax lineolate punctate, with weak plicæ at sides of basal part *H. wilkinsoni*, sp. n.
2. Front at least partly shining 2.
2. Face dark green; mesonotum minutely lineolate and subreticulate, with punctures separated by more than a puncture width, but denser than on any other species of the group; area very densely and minutely striate, the striae oblique *H. angustulus* Ckll.
- Face and front blue-green, clypeus and supra-clypeal area black; mesonotum minutely, largely transversely lineolate, with widely separated punctures; area very densely and minutely pitted *H. chloronotus* Ckll.
3. Area minutely lineolate and reticulate, the basal half with distinct, not very dense, dendriform plicæ; upper part of clypeus green; front dull, a little shining; mesonotum minutely lineolate and reticulate, with feeble very widely separated punctures *H. zambabwicus* Ckll.
- Area with at most very weak and indistinct plicæ or dendriform markings 4.
4. Mesonotum polished, brassy green *H. kabotiellus* Ckll.
- Mesonotum bluish green; abdomen much more green *H. bianonis* Ckll.
- (These both have the punctures of mesonotum widely separated.)

Halictus nigrifrons, sp. n.

♂.—Length about 5 mm.; black, including clypeus and mandibles; pubescence extremely scanty, not conspicuous on face; head broad, but clypeus strongly produced, shining; antennæ long, reaching about to metathorax, flagellum obscurely reddish beneath; mesonotum and scutellum polished; postscutellum without white tomentum; area of metathorax large, slightly shining, with weak plicæ on basal part, the surface otherwise lineolate; tegulæ dark reddish; wings dusky hyaline, the apical field brownish; stigma and nervures brown, outer nervures not weakened; second submarginal cell narrowed above, receiving recurrent nervure not far from end; legs black; abdomen claviform, but thick and rather stout, with no spots or bands of hair.

Uganda; Kampala, Sept. 27, 1915 (*C. C. Gowley*, 5478).

Very similar to *H. tenkeanus* Ckll., but lacks the deep median groove on mesonotum. Also very like *H. kasuloi* Ckll., but area of metathorax different, and clypeus more shining and more produced.

Halictus yolensis, sp. n.

♂.—Length about 5 mm.; black, with thin white pubescence, conspicuous on face (covering sides of clypeus), on cheeks, on tubercles (and a crescentic mark just behind them), on margins of mesonotum, densely on postscutellum, and forming basal bands on second and third tergites, the latter somewhat interrupted; mouth-parts dark, but clypeus with a broad pale yellow apical band; mesonotum and scutellum entirely dull; area of metathorax shining, with strong irregular plicæ; tegulæ small, pale reddish; wings hyaline, stigma light reddish; outer nervures not weakened; first recurrent nervure interstitial; legs black, with the knees pale, and the tarsi reddish; abdomen polished, rather broad and short.

N. Nigeria: Yola, 1909 (*J. M. Dalziel*). Resembles *H. mulangensis* Ckll., but differs in the venation and colour of pubescence. The hind tibiæ are robust, as in *H. mulangensis* and *H. hædillus* Vachal.

Halictus hargreavesi, sp. n.

♀.—Length about 8 mm., anterior wing 5; black, with slender white (faintly creamy) tegumentary bands on the first four abdominal tergites; pubescence dull white; the hairs long on head and thorax; head about as broad as long; clypeus dull, antennæ black, the flagellum brownish beneath; mesonotum dull; area of metathorax slightly shining, not very long; tegulæ black, wings slightly dusky apically; stigma pale reddish; nervures dark; second submarginal cell very broad, receiving recurrent nervure some distance before end; third submarginal broad, the outer nervures somewhat pale, but very distinct; legs black, with the middle tarsi reddish, the hind tarsi clear red; abdomen shining, without hair-bands or spots. Hind spur with about six obtuse, short teeth.

Uganda; N. Bugishu, Jan. 12, 1930, alt. 8500 ft. (*H. Hargreaves*).

This may be compared with two other species having narrow tegumentary bands as follows:—

Larger, about 10 mm. long, mesonotum dull .	<i>aberdaricus</i> Ckll
Smaller	1.
Mesonotum dull; hind tarsi clear red	<i>hargreavesi</i> Ckll.
Mesonotum shining; hind tarsi dusky	<i>abderoni</i> Ckll.

Halictus hancocki, sp. n.

♂.—Length about 6·7 mm., anterior wing 5; shining black, the abdomen nearly parallel-sided; pubescence scanty, white, rather dense at sides of face; clypeus entirely black; antennæ short for a male, the flagellum dusky reddish beneath; front dull, but top of head highly polished; mesonotum highly polished, with scattered distinct punctures; scutellum depressed in middle, appearing as two shining spots: postscutellum large; area of metathorax a short curved channel, strongly plicate; tegulæ black; wings faintly greyish, stigma and nervures brown; second submarginal cell high and narrow, receiving recurrent nervure some distance from end; third submarginal cell broad; marginal cell obtuse and briefly appendiculate at end; legs black, the tarsi brownish apically; abdomen highly polished, with bands of rather inconspicuous white tomentum at base of second to fourth tergites; apex of abdomen highly polished; the abdomen ends in a rounded plate, and on each side is a short tooth.

Uganda: Burunga, May 29, 1926 (*G. L. R. Hancock*). By the structure of the abdomen, and the obtuse marginal cell, as well as the entirely black clypeus, this must be associated with the South African *H. bowkeri* Ckll. and *H. trimeni* Ckll.

Other males seen from Uganda have the mesonotum dull, or if it is polished, the tegulæ red.

The related *H. ituricus* Ckll., from the Belgian Congo, is larger, with red tarsi. *H. libericus* Ckll., from Liberia and S. Nigeria, is also related. It is distinguished by the dull mesonotum, and area of metathorax more coarsely plicate.

H. michaelis Ckll. differs conspicuously from *H. hancocki* by the brownish wings, the much stouter abdomen, and the dull, strongly and closely punctured mesonotum.

Halictus entobbianus, sp. n.

♀.—Length about 8·5–9 (varying with contraction), anterior wing 6·5 mm.; shining black, the mesonotum, scutellum and abdomen polished, wings dilute brownish; pubescence scanty, white, conspicuous erect white hair at extreme base of abdomen; clypeus, supraclypeal area

and lower part of face shining, but front and vertex dull, a highly polished spot just in front of ocelli; antennæ black; mesonotum not grooved; scutellum with a median groove, postscutellum large and dull; area of metathorax not very large, glistening, with fine sculpture; tegulæ black; stigma and nervures dark brown; second submarginal cell broad, receiving recurrent nervure not far from end, third hardly broader than second; tarsi somewhat brownish; abdomen with indistinct bands of white hair at bases of tergites. Hind spur pectinate. Tongue slender.

Uganda: Entebbe, March 15, 1913 (*C. C. Gowdey*, 3158). Other specimens, apparently the same species, show the mesonotum grooved, and the scutellum not or not appreciably grooved, and in one specimen the hair-bands at bases of tergites are very distinct. The specimens are all from Entebbe: Oct. 1, 1909 (*Gowdey*); Jan. 21, 1913 (*Gowdey*); Nov. 3, 1910 (*Gowdey*). Aug. 1912 (*Gowdey*). One is marked "not in British Museum."

Apparently related to *H. pernitens* Ckll., from South Africa, but it is larger, with the outer nervures not much weakened, and the flagellum not red beneath.

Halictus somereni, sp. n.

♀.—Length about 8 mm., anterior wing 6 mm.; shining black, the mesonotum and scutellum polished; pubescence white; antennæ and tegulæ black. Related to *H. entebbianus*, but compared with the type of that species, differing as follows:—smaller; wings clear hyaline (not brownish), first recurrent nervure meeting second intercubitus, third submarginal cell more produced at end; area of metathorax short, and more strongly sculptured; abdomen broader, the four greyish-white basal hair-bands all very distinct. The tongue has a linear extension, not very long.

Uganda: type, from Nairobi, April, 1928 (*Dr. Van Someren*). One, Nairobi, March, 1928 (*Dr. Van Someren*); one, Entebbe, Oct. 1, 1909 (*Gowdey*)—this had been sent to Friese, and returned marked *Halictus* sp. ?; one, Masaka, April 2, 1909 (*Gowdey*); one, Nagunga, Aug. 21, 1913 (*Gowdey*).

Halictus stellatifrons, sp. n.

♀.—Length about 7 mm., anterior wing slightly over 5; black, with inconspicuous greyish-white pubescence; mandibles and antennæ black, tegulæ very dark brown; head broad and short, clypeus not or hardly shining; front dull, but a shining spot in middle a little above antennæ; top of head shining; mesonotum closely punctured, somewhat shining, but not polished; scutellum and area of metathorax slightly shining, the latter finely plicetulate; wings faintly dusky, stigma and nervures brown, outer nervures distinct; lower section of basal nervure abruptly bent in middle; second submarginal cell very narrow, with parallel sides; first recurrent nervure joining basal corner of third submarginal cell; third submarginal cell large, but not extended apically; legs black, with the tarsi reddish apically; anterior and middle femora broad, with a keel-like extension below; hind spur with an obtuse spine, like the last joint of a finger, followed by two short obtuse oblique teeth, and rudiments of two others; abdomen broad, shining but not highly polished; when looked at from behind there is the appearance of a linear or pale band along apical margin of tergites 2 and 3, and there are indistinct patches of pale hair at sides of tergites; sternites with fringes of long hair.

Aberdare Mts.: east side of edge of forest, alt. 7300 ft. Feb. 24, 1911 (*T. J. Anderson*).

Compared with *H. aberdaricus* Ckll., also from the Aberdare Mts., it is easily distinguished by the lack of tegumentary bands on abdomen, and the moderately shining mesonotum. Among those with shining mesonotum, *H. andersoni* Ckll. is separated by being smaller, with linear white tegumentary bands.

H. lamborni Ckll. differs by the red mandibles and tegulæ, but has a similar hind spur. It also has the mesonotum dull. *H. stellatifrons* is distinguished from *H. meruensis* Friese by the broad (not oval) head and the pale wings (very brown in *meruensis*).

A green *Halictus* with exactly the same data as *H. stellatifrons* is referred to *H. hotoni* Vachal, though it seems to have the mesonotum more polished than usual.

Halicbus filiferellus, sp. n.

♀.—Length about 7 mm., anterior wing 5.4; black, with scanty dull white pubescence, the abdomen without hair-bands or spots; head elongate-oval, but not so narrow as in *H. zacephalus* Ckll., from Natal; clypeus rather dull, but supraclypeal area polished; labial palpi short, but maxillary palpi excessively long and slender; mandibles black; apex of clypeus with long shining white hairs; antennæ black; mesonotum and scutellum polished; scutellum not evidently bigibbous; area of metathorax rather large, dullish, with a broad shining margin, no plicæ visible; mesonotum with a median groove on anterior half; tegulæ very dark brown; wings dilute greyish, stigma reddish brown, nervures brown, outer nervures weakened; second submarginal cell broad, somewhat contracted above, receiving recurrent nervure near end; third submarginal cell bulging outward apically; legs entirely dark; abdomen polished, with pale pubescence at apex, and long pale hair on sternites.

Uganda: Bugisha, Jan. 12, 1930 (*H. Hargreaves*). The altitude is 8500 ft. Related to *H. megadelphus* Ckll., and *H. meruensis* Friese. From the former it is known by the polished mesonotum and scutellum, and from both by the paler wings. Whether the related species have similar palpi is not known. *H. filiferellus* comes from a much higher altitude than the related species.

XLV.—Notes on the Jurassic Flora of Yorkshire, 22–24.

By TOM M. HARRIS, University of Reading.

22. *Otozamites gramineus* (Phillips). (Figs. 1–3.)

1828. *Zamia Goldiæi* Brongniart, p. 94. (Nomen nudum.)

1929. *Cycadites gramineus* Phillips, pl. x, fig. 3. (Fragment.)

1849. *Otozamites Goldiæi* Brongniart, p. 106. (Name only.)

1875. *Otozamites Goldiæi* Saporta, p. 128, pl. xcv, fig. 1. (Figure but no description.)

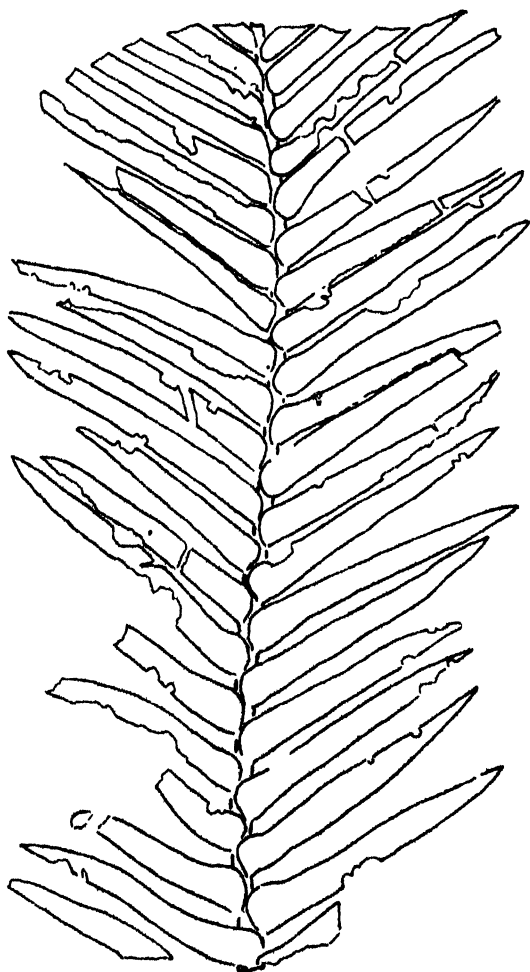
1875. *Otozamites gramineus* Phillips, p. 223, lign. 51, pl. x, fig. 3. (Leaf-fragments, description.)

1900. *Otozamites gramineus* (Phillips) Seward, pp. 7, 16, 197. (Name mentioned, but no description.)

1917. *Phlophyllum pecten* (non Phillips) Seward in part, p. 519, text-fig. 592,

The first publication of this species is Phillips's figure with a name: Brongniart's name *O. Goldiæi* is earlier but a *nomen nudum*. Later Saporta figured Brongniart's

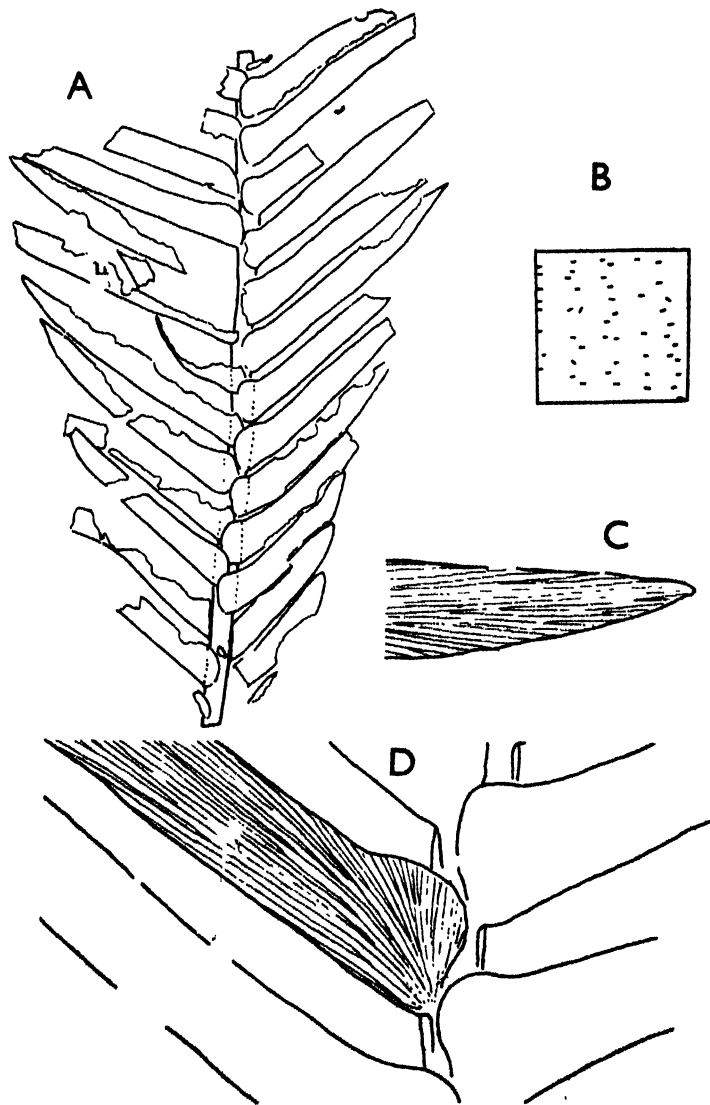
Fig. 1.



Otozamites graminæus.
Specimen bearing label "A." $\times 1$.

specimen as *O. Goldiæi* and Phillips (1875) figured another specimen with a brief description. Seward (1900) seems

Fig. 2.



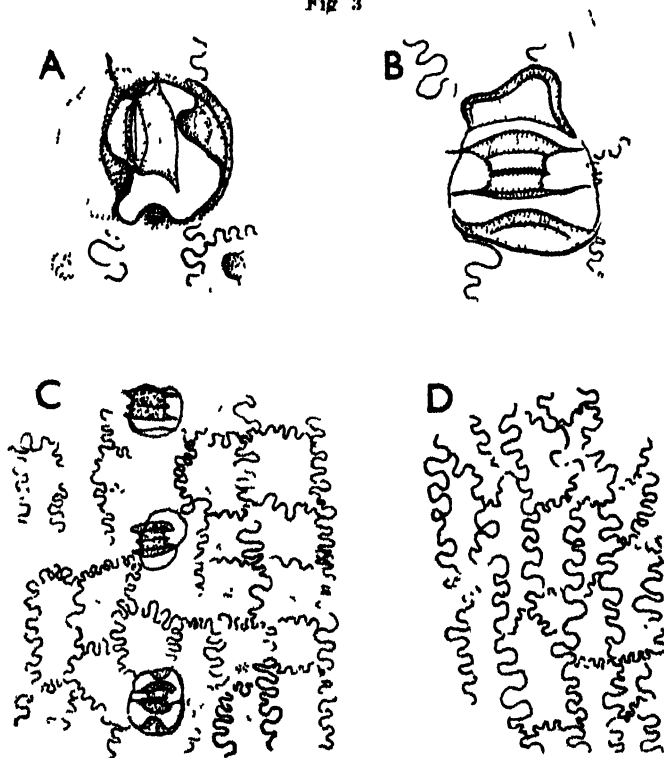
Otosamites gramineus.

A, specimen bearing label "F," $\times 1$. B, 1 sq. mm. of lower epidermis of specimen "F," showing distribution and orientation of stomatal apertures. C, apex of pinna, specimen "L," $\times 3$. D, rachis and lower part of pinna, specimen "A," $\times 3$.

to have been doubtful about the distinctness of *O. gramineus*; he mentioned it in certain lists but did not include it in the body of his catalogue, and he included the name *O. Goldisei* as a synonym of *Ptilophyllum pecten*. Later (1917) he figured what appears to be a typical leaf of *O. gramineus* as an aberrant form of *P. pecten*.

The five specimens described here are preserved in a sandy shale and labelled "Whitby," and some have old

Fig 3



Otozamites gramineus.

- A. stoma (orientated longitudinally) with somewhat contracted pit, specimen "A," $\times 500$ B. exposed stoma, specimen "F," $\times 500$.
C. lower cuticle, specimen "A," $\times 200$ D. upper cuticle, specimen "A," $\times 200$.

labels giving the name *Otozamites gramineus*. Associated are numerous leaves of *Ptilophyllum pectinoideum*, which is characteristic of the Lower Estuarine rocks of the

Whitby district. Phillips gives the localities as Whitby and Saltwick and the age as Lower Estuarine.

The specimens are in the Phillips Collection in the Geology Department, Oxford University, and I am indebted to Professor Douglas for lending them for description.

Diagnosis (emended). -Leaf of moderate length (possibly 30 cm.), typically 7-10 cm. broad in the middle region, narrower near the apex and base. In middle region of leaf, pinnæ arising at an angle of 60-70° to the midrib, usually separated by gaps of 1-2 mm. Pinna attached by a small area at the lower basal corner; upper basal corner (auricle) rounded and expanded to the extent of 1-2 mm., but seldom overlapping the pinna on the opposite side of the rachis. Margins of pinna beyond auricle at first almost parallel, then gradually tapering to an acute point. Pinnæ at apex and base of leaf shorter and with a more obtuse apex; those at apex with scarcely any basal lobe; those at base with a well-developed basal lobe.

Veins slender, occurring at a concentration of about 4 per mm., radiating from the point of attachment, the uppermost running parallel with the rachis or slightly across it. Veins dichotomising at all levels in the leaflet, many ending in the lateral margins.

Cuticle of medium thickness, about 1μ on both sides. Upper cuticle without stomata or trichomes, showing uniform rectangular cells in rows. Walls distinctly marked, strongly sinuous; surface flat, without any papilla. Lower cuticle showing stomata in narrow bands separated by slightly wider bands along the veins. Cells rather wide, often nearly square, with finely marked sinuous lateral walls. Nearly all cells showing a thickened area in the middle of the surface, usually forming a round papilla, but sometimes a ridge along the middle of the cell. Papillæ solid, only becoming hollow near stomata. Stomata usually forming two (sometimes one, sometimes three) indefinite files in each stomatal band, irregularly spaced, tending to be transversely orientated. Guard-cells and subsidiary cells sunken in a wide shallow pit, mouth of pit usually exposed but occasionally sides overhung by the hollow papillæ of neighbouring epidermal cells. Subsidiary cells small with a thickened surface; papillæ not or only very slightly developed. Guard-cells fairly thickly cutinised. Trichomes absent.

Discussion.—The foregoing diagnosis is based on five very similar specimens. They are indifferently preserved, but it was possible to prepare cuticles from every one. These cuticles agreed with one another although the epidermal papillæ are fainter in some leaves than others.

Identification.—The present specimens match Phillips's (1929) figure of *O. gramineus*, and also Saporta's (1875) figure of "*O. Goldiæi*," but resemble no other species closely. None of the present specimens show the leaf apex and so none can be compared with Phillips's 1875 figure (fig. 51). The veins agree in their direction with those given in Phillips's and Saporta's figures but are far more numerous. I am sure, however, that these early drawings give only a general impression of the veins, not attempting to represent them individually.

The Portuguese specimen named *Otozamites gramineus* var. *mundæ* by Morris (1850) is distinct, having a much better developed auricle.

For comparison see Note 24. The works quoted in this note are given in Note 24.

23. *Otozamites gracilis* Phillips. (Figs. 4, A, 5.)

1875. *Otozamites gracilis* Phillips, p. 224, fig. 52.

1892. *Otozamites gracilis* Phillips, Fox Strangways, p. 139. (Mention in list with localities.)

1900. *Williamsonia pecten* (non Phillips) Seward in part, pp. 16, 190, 199 (included as a synonym).

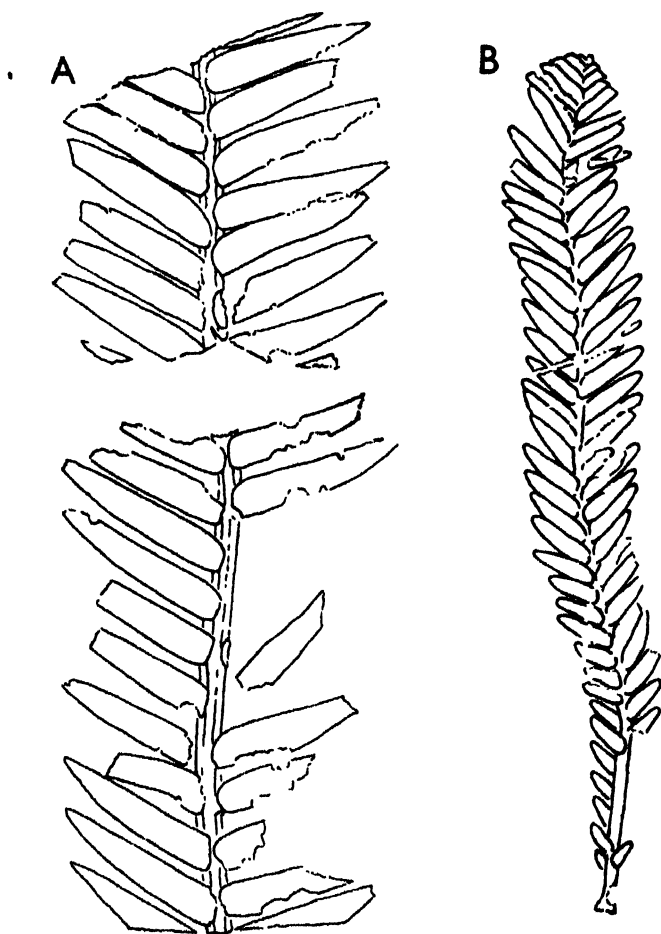
'*Otozamites gracilis*' of Peistmantel, 1877, pl. vii., appears to be distinct.

The single specimen bears an old label giving the name "*Otozamites* probably *O. gracilis*" and another giving the name "*Pterophyllum angustifolium* Ph." One label gives the locality 'Upper shale, Near Scarborough.' and another "Middle Estuarine." The matrix, however, looks like that of the Lower Estuarine rock of other old specimens from Haiburn Wyke, which I suspect may be the true origin. Phillips's specimen came from Haiburn Wyke.

The specimen is in the York Museum and I am indebted to Mr. R. Wagstaffe for lending it.

Emended diagnosis.—Length of leaf unknown, width typically 4–5 cm. Pinnæ (over middle region of leaf) arising at an angle of 70°–80° to the midrib, about 1 mm. apart. Pinnæ almost straight, attached by a fairly large

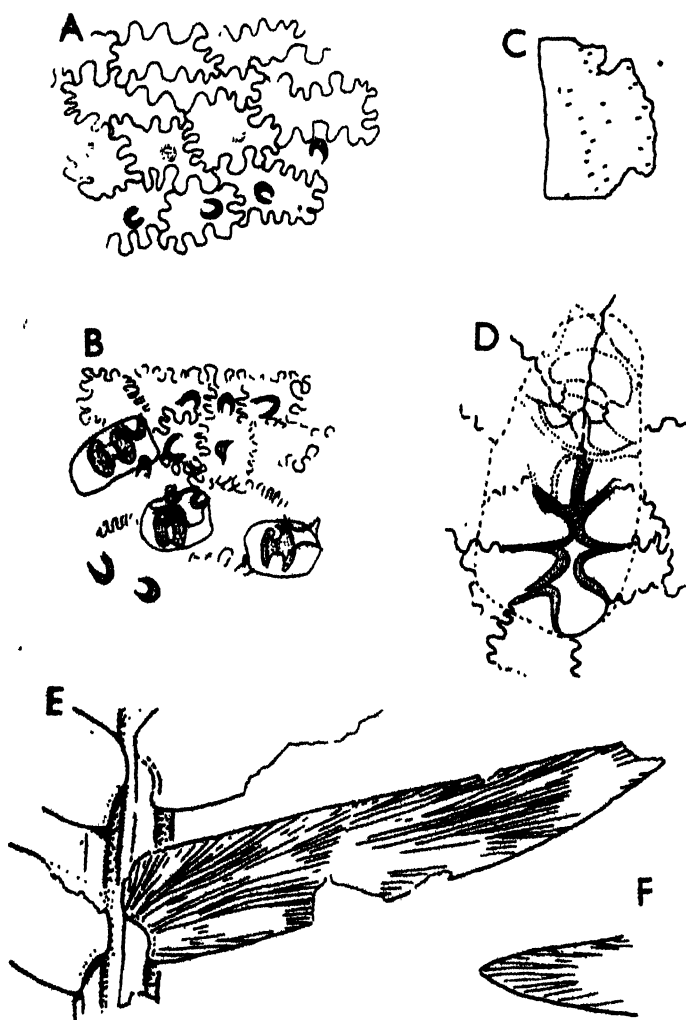
Fig. 1.



Otozamites gracilis and *O. penna*.

A, *O. gracilis*, outline of York Museum specimen, $\times 1$.
B, *O. penna*, Herries Coll. 1134, $\times 1$.

Fig. 5.

*Otosamites gracilis.*

A, lower outcicle of leaf-margin showing marginal cells (drawn at the top) without papillae, $\times 200$. B, lower outcicle showing part of a stomatal band, $\times 200$. C, fragment of lower outcicle (margin on the left) showing stomatal bands, $\times 20$. D, stoma showing mouth of stomatal pit; subsidiary cells and guard-cells shown by broken or dotted lines, $\times 500$. E, petiole and greater part of a pinna, $\times 8$. F, apex of a pinna, $\times 3$.

area of lower basal corner, upper basal corner not at all expanded, margins tapering at first very gradually, afterwards more quickly to a rather acute apex.

Veins slender, occurring at a concentration of about 4 per mm., radiating from the lower corner of the pinna; even the uppermost diverging from the main rachis at a small angle. Veins dichotomising at all levels in the pinna, many ending in the lateral margins. Substance of lamina not very thick, margin unspecialised.

Cuticle of medium thickness (about $1\ \mu$). Upper cuticle unknown (not preserved); marginal region of lower cuticle (which is presumed to resemble the upper cuticle) showing cells with well-marked sinuous walls. No median papillæ present.

Lower cuticle showing stomata confined to bands, about as wide as the bands with none along the veins. Stomata forming one, two or three ill-marked longitudinal files, irregularly spaced, mostly transverse to the veins. Epidermal cells showing sinuous walls and a prominent hollow papilla, those near stomata converging over the aperture. Guard-cells and subsidiary cells sunken, mouth of stomatal pit constricted by strongly-developed ingrowths from surrounding cells. Subsidiary cells small, thickly cutinised, probably not possessing any papilla.

Trichomes probably absent.

Discussion.—The present specimen is indifferently preserved in sandstone and has been further damaged by varnish, and it was only possible to obtain minute preparations of the cuticle from the lower side, nothing at all from the upper. It is certainly distinct from *O. gramineus* and *O. penna* and is identified with the specimen figured by Phillips because it has pinnae of similar shape. The veins are not exactly as in Phillips's drawing, where they are shown running parallel at the pinna base, but it is presumed that they were imperfectly drawn and described.

Otozamites lanceolatus of Leckenby 1864 (non Phillips), which Phillips (1875) regards as a synonym of *O. gracilis*, appears to be distinct, as the pinnae show a sigmoid curve (as in *Ptilophyllum pectinoideum*).

O. gracilis is compared with other species in Note 24, where the works quoted here are cited.

24. *Otozamites penna*, sp. n. (Figs. 4, B, 6, 7.)

† 1900. *Williamsonia pecten* (non Phillips) Seward in part, pl. III. figs. 5, 6 only.

Introduction.—This is a rather small leaf closely resembling in general appearance *Ptilophyllum pecten* and *pectinoideum*. Its nature was evidently recognised by some early collector, for one of the specimens has a label giving the name "*Otozamites* sp." but no one else has distinguished it, although it differs considerably in definite details from *Ptilophyllum*.

The present material consists of ten leaves or fragments preserved on three blocks of sandy shale. Two blocks are labelled "Lower shale, High Whitby," the third, though unlocalised, is associated with the Lower Estuarine leaf *Ptilophyllum pectinoideum*, so that its age can be safely regarded as Lower Estuarine.

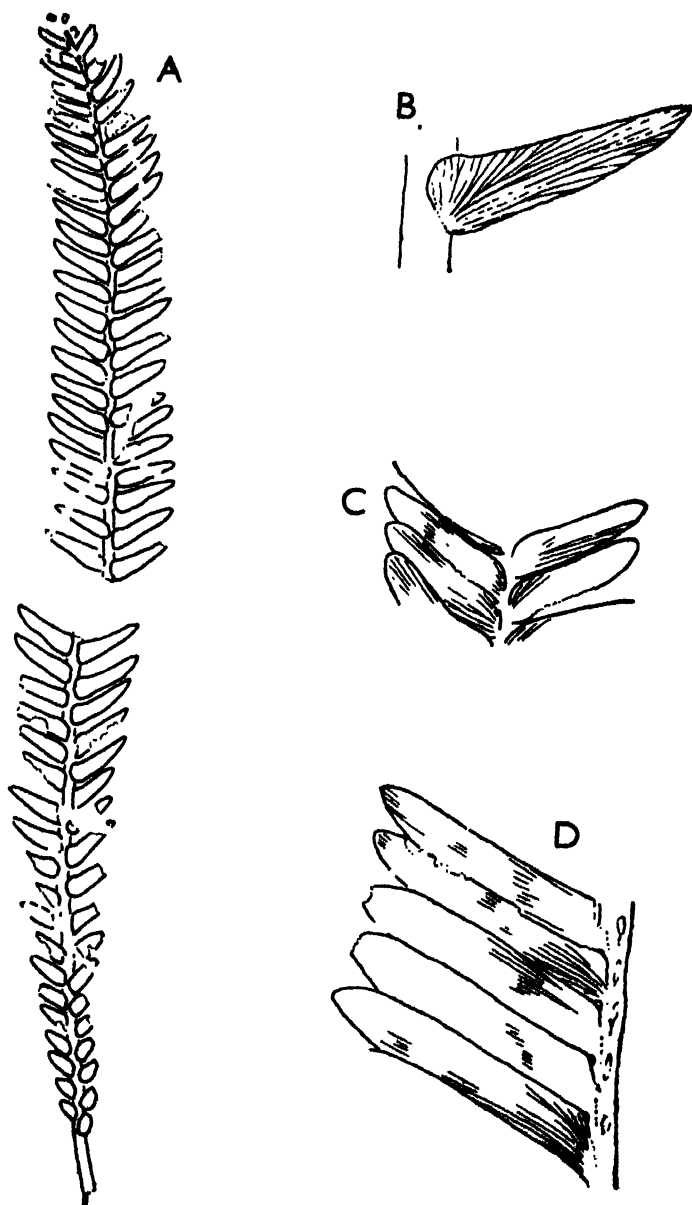
The specimens are in the Herries Collection, York Museum, and I am indebted to Mr. R. Wagstaffe for lending them for description.

Diagnosis.—Leaf typically 15–20 cm. long, 1.5–3 cm. wide in the middle and upper regions, tapering gradually towards the base. Pinnæ usually touching or overlapping in the upper part of the leaf but about 1 mm. apart below. Pinnæ arising at an angle of 80° to the rachis, attached along the lower half only of the edge facing the rachis, upper basal angle not expanded at all, or only very slightly expanded, not crossing the mid-line of the rachis. Margins at first parallel, then contracting to a rather blunt point. Veins slender, traversing the lamina at a concentration of 4–5 per mm. Substance of lamina not very thick, margins unspecialised.

Cuticle.—Both cuticles are about 1 μ thick.

Upper showing neither stomata nor trichomes, consisting of rows of nearly uniform cells, veins scarcely indicated. Cells tending to be rectangular, walls finely but distinctly marked, sinuous; surface without any papilla or distinct sculpture.

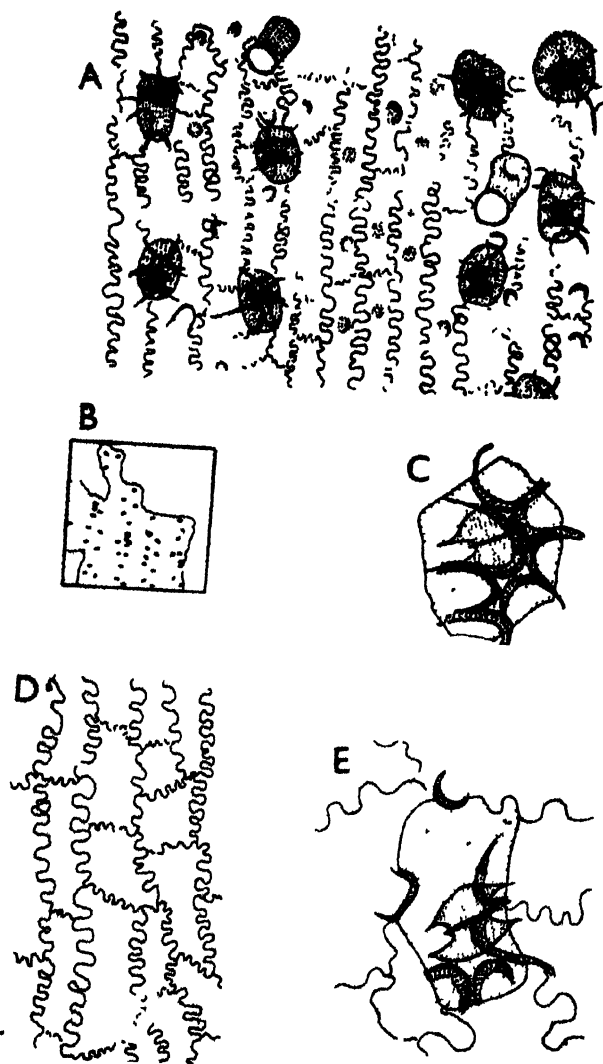
Lower cuticle showing stomata in bands between the veins, stomatal bands equalling vein-bands in width. Stomata often in two rather indefinite files in each stomatal band, irregularly spaced, orientated more or less transversely. Epidermal cells rectangular or irregular, cell



Otozamites petraea.

A, Type-specimen, Herries Coll. 2102, Saltwick. The break in the middle is due to a ripple-mark in the sandstone. B, a single leaflet of 2102 showing veins, $\times 4$. C, part of specimen, Herries 1134 (text-fig. 4, B), showing some of the veins, $\times 2$. D, part of widest specimen, Herries 1159 (High Whitby), showing veins and scars of detached leaflets.

Fig. 7



Otzomastes penna.

A, lower cuticle showing a vein and two complete stomatal bands with trichomes, $\times 200$. B, fragment of lower cuticle showing orientation of stomata (black lines) and trichome bases (circles). A few trichomes may have been missed. The square is 1 sq. mm. C, stoma, almost concealed by papillae of surrounding cells, $\times 500$. D, upper cuticle, $\times 200$. E, more exposed stoma, $\times 500$. All from the type-specimen.

outlines sinuous, finely marked and often indistinct. Cells usually showing a median papilla; papilla either a mere thickened area or a hollow raised area, never conspicuous, and often indistinct. Surface sculpture of coarse mottling. Guard-cells and subsidiary cells sunken in a pit, sides of pit overlapped to a considerable extent by large hollow papilla-like outgrowths from surrounding cells. Subsidiary cells small, thickly cutinised, without papillæ of their own.

Trichomes occurring in small numbers in stomatal bands, consisting of a more or less reduced and thickened epidermal cell bearing a cylindrical outgrowth of moderately thin cuticle, about 50μ long, 25μ broad.

Discussion.—The present specimens are very similar to one another; the largest and smallest are figured. Those on one block show a curious feature of preservation; the upper cuticle has vanished, but the anticlinal walls of the lower epidermis are extensively preserved, so that the cuticle has a superficially different appearance.

Comparison.—*O. penna* differs from species of *Ptilophyllum* in the shape of its pinnæ. In *Ptilophyllum* the lower margin of a segment is distinctly decurrent as a rule, but here as in a typical *Otozamites* it is slightly contracted. The attachment of the pinna along the lower part of the margin instead of its whole length is another difference, and the radiating venation results from this attachment. *O. gramineus*, *O. gracilis* and *O. penna* resemble one another but are distinguished by certain details, which are constant in the material available. *O. gramineus* has the longest pinnæ (35–50 mm.), with a distinct though small basal lobe. *O. gracilis* (taking the present specimen to be typical) has intermediate pinnæ (25 mm.), with a sharp apex and no basal lobe. *O. penna* has the shortest pinnæ (6–10 mm.), with a blunt apex and with no basal lobe, or only a very small one. In cuticle, *O. gramineus* has the most exposed stomata and the papillæ of the ordinary cells of the lower epidermis are small and solid. *O. gracilis* has the most protected stomata and most strongly developed epidermal papillæ which are prominent and hollow; *O. penna* is intermediate in these respects and is distinguished by having short cutinised hairs among the stomata, such hairs being absent in the other two.

Although these three species are rather extreme members of their genus, a few others are known which match them fairly closely in the shape of the pinnæ. The Cretaceous

leaf *O. goeppertianus* (see Seward, 1917, p. 538) has pinnæ like those of *O. gramineus*, though arising at a smaller angle. Numerous specimens which have been described as species of *Ptilophyllum* are perhaps comparable with *O. gracilis* and *O. penna*, but closer investigation is needed.

In cuticle *O. gracilis* is rather like *O. pterophylloides* (see Florin, 1931), while *O. gramineus* is more like *O. bornholmensis* (see Florin, 1933); these species differ, however, in their rather wider leaflets.

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XLVI.—*Note on the Terrestrial Isopod Armadillidium speyeri Jackson.* By WALTER E. COLLINGE, D.Sc., President of the Northern Ecological Association.

I HAVE recently received from Mr. Edward R. Speyer, M.A., a collection of living specimens of *Armadillidium speyeri* Jackson. They are of various ages and vary greatly in colour-markings.

Dr. Jackson, in his original description of this species*, states that the colour is "general surface varying from

* Ann. & Mag. Nat. Hist. 1923 (ser. 6) xi. pp. 224-227, figs. 1-5.

slate-blue to dark brown. A continuous narrow light band runs down the middle of every somite, but not on the head or 'telson.' The coxal plates are light with narrow, dark, posterior margins. Between coxal plates and median line the dark areas of each somite are broken up with light mottling."

From an examination of hundreds of specimens, I have come to the conclusion that there are two forms of this species; one is almost uniform dark brown, with only faint traces of a median dorsal band and a single and similar band on each side dorsal to the pleura. This, in my opinion, is the type; moreover, its surface, as its author states, has "very minute granulations."

Hitherto no variation from the type has been described, but I have a form from Cheshunt which stands out very distinctly from the type. Its characters are as follows:—

Var. jacksoni, nov.

Colour light bluish yellow at the margins of the somites, with two very distinct light brown median bands and two very similar lateral bands on each side dorsal to the pleura, with faint bluish-white or yellow areas between them all. Surface of the mesosome and metasome smooth.

Loc.—Cheshunt, Herts, 30. viii. 1945 (*E. R. Speyer*).

Specimens kindly sent to me from a greenhouse at Norwich by Mr. A. E. Ellis, M.A., F.L.S. (viii. 1942) are all referable to this new variety.

I suggest that the variety *jacksoni* is more nearly related to *Armadillidium nasatum* Budd-Lund than is the species *A. speyeri*.

I have pleasure in associating with this interesting variety the name of Dr. H. Gordon Jackson, the author of the species, and as an appreciation of his work on the Terrestrial Isopoda. To Mr. Edward R. Speyer I tender my thanks for the specimens and previous collections of this species.

XLVII.—*The Type of the Genus Ammonites.*

By L. F. SPATH.

MUCH has been written on this subject, but the problem is not yet settled and renewed discussion seems necessary. It is desirable to formulate an objective statement of the case for eventual presentation to the International Commission and subsequent standardization of the name. The writer's interpretation may or may not be acceptable to the Commission, for there are certain difficulties, as will be seen in the following pages. What matters is to get a final ruling; for though many authors may not realize the importance of having this problem settled, it has an adverse influence on the nomenclature of a number of related genera. In his recent monumental work on the Ammonites of the Jurassic and Cretaceous, Roman (1938), for example, played havoc with the genotypes of the "arietid" genera. In his discussion of the relative advantages of *Coroniceras* and *Arietites* (its synonym), he even suggested that the original genus *Ammonites* might be ignored; but that, of course, is out of the question.

It is now generally accepted that the genus *Ammonites* dates from Bruguière (1789), since he was the first to give proper specific names to a number of *cornua ammonis** figured by previous authors. Some authorities quote Geener (1758) as the first post-Linnean author to use the term *Ammonites*, but he did not mention a single species and therefore cannot be claimed to have priority before Bruguière. To both, however, as to all the other early authors, *Ammonites* was merely another term for *cornu ammonis*, and it included all the heterogeneous forms scattered in literature, without any systematic arrangement.

Lamarck, at first (1799), also listed the genus without mentioning any species, but later (1801) he quoted *Amm. bisulcatus*, one of Bruguière's species, as the only example of the genus; and he is thus commonly taken to have

* Probably not the original *cornua ammonis* of Pliny, which may have been Tertiary gastropods (e. g., the casts described as *Natica ammonis* Blanckenhorn); for no ammonites with any resemblance to a ram's horns occur in Libya or Egypt.

been the first author to indicate the genotype. Meek (1876) was the first modern authority to state that the citation in Lamarck fixed the species *Amm. bisulcatus* Bruguière, as "the typical form of the genus."

There had been several attempts to subdivide this old genus *Ammonites* by separating from it groups of unrelated forms, characterised by some common feature, e. g., an evolute or an involute shell (*Orbulites* Lamarck, *Simplegades* Montfort, *Globites* de Haan, etc.), but since Montfort, for example, described as type of his genus *Ammonites* the living *Nautilus umbilicatus*, and since *Globites* was made to include such diverse objects as the flat Lower Liassic *Amm. loscombi* as well as the Gault gastropod *Bellerophina minuta*, these early classifications did not receive much attention or favour. Reynès (1867), indeed, went so far as to say they could not be taken seriously. They were in fact abandoned, as Fischer (1879) pointed out, by Lamarck himself and the majority of authors of the first half of the nineteenth century who took the genus again in the wide sense in which it had been understood by Bruguière.

From 1832 onwards L. v. Buch's "groups" or "families" within the genus *Ammonites* held the field. They were adopted and added to by all the foremost systematists, notably d'Orbigny and Quenstedt, and retained by some long after the general splitting-up of the genus *Ammonites* had begun. This modern subdivision into smaller genera may be said to have started with Suess (1865), and though it was promptly rejected by Reynès in 1867, Hyatt in that same year created a large number of independent genera for Liassic forms alone.

As already mentioned, however, Meek in 1876 was the first to restrict the genus *Ammonites* itself. He stated that, however much the original genus might be divided or subdivided, the name *Ammonites* should be retained for the group to which *Amm. bisulcatus* belonged. It thus seemed to Meek that the genus *Coroniceras* Hyatt became an exact synonym of his restricted *Ammonites*, a significant conclusion in view of subsequent developments. Curiously enough, Hyatt, who, unlike most of his contemporaries generally paid attention to the Rules, did not accept Meek's restriction or abandon his own genus

Coroniceras; and the confusion he caused in this one comparatively compact family of Ammonitidæ is still reflected in the nomenclature of some authors of the present day, including the writer's earlier work.

Hyatt first used the term "Arietidæ" in 1870 (to replace his family "Discoceratidæ" of 1867) and since, in his paper on the "Evolution of the Arietidæ" (1873) he still spoke of a "genus or group" *Arietes* of von Buch, it is clear that Arietidæ is not a misprint for Arietitidæ but an irregularly formed name, like Angulatidæ, contrary to Art. 5 which requires the family name to incorporate the name of the typical genus. In his well-known work, the "Genesis of the Arietidæ" (1889), in fact, Hyatt rejected the genus *Arietites*, Waagen, 1869, and declared his own *Coroniceras*, created two years earlier, to be the typical genus of the "family" Arietidæ. Yet he did not adopt the family name Coroniceratidæ or more correctly Ammonitidæ, since Meek had in the meantime shown *Coroniceras* to be a synonym of *Ammonites*, s. s.

Hyatt was equally irregular in his treatment of the so-called suborder Ammonitinæ. This name, really a subfamily name, was used by him (1889) for one of the subdivisions of the Order Ammonoidea, comparable with the other five "suborders" he recognized, though he gave them all subfamily names (Clymeninæ, Goniatitinæ, Ceratitinæ, Lytoceratinæ, and Arcestinæ). Moreover, Hyatt stated that his "family" Arietidæ represented the "normal forms" of the Ammonitinæ, but as this "suborder" was said to range from the Triassic to the Cretaceous, this cryptic passage seems particularly fortuitous.

In his 1900 classification (in Zittel-Eastman) Hyatt abandoned the suborder Ammonitinæ and still ignored the genus *Ammonites*, but he now introduced a "superfamily" Arietida in addition to the "family" Arietidæ, yet, again in defiance of the Rules, he listed a genus *Arietes*, Waagen (which should be *Arietites*) only as a synonym of the genus *Coroniceras*. So much confusion was not readily disentangled; and the question was not opened again until 1922 (Spath), but Buckman in the following year, while giving an incomplete historical review of the genus *Ammonites*, made no mention of Meek's restriction or the discrepancies in Hyatt.

The first author to accept the restriction of *Ammonites* in Meek's sense was Fischer (1879), who quite rightly put not only *Coroniceras* but also *Arietites* in its synonymy. In 1882 Fischer again cited *Amm. bisulcatus* as the only species of the restricted genus *Ammonites*, and he reproduced d'Orbigny's ventral view of that form. D'Orbigny's figure, in fact, copied also by Hyatt (1900) and recently again by Roman, was the earliest recognizable if not the only illustration in existence when Meek and Fischer wrote, apart from the unreliable figures in such ancient oryctographers as Lister (1678), Lang (1708), and Bourguet (1742), opinions on which differ considerably.

When the writer, in 1922, had occasion to refer to the genus *Ammonites*, he did not enter into historical details but merely remarked, parenthetically, that he restricted it to the group of *Amm. bisulcatus* Bruguière, in d'Orbigny. Knowledge, by the reader, of the previous history of the genus was taken for granted, as also the fact that Meek, in common with every other author, had to rely on d'Orbigny's interpretation of Bruguière's species. As was explained more fully in 1924, d'Orbigny's figure of 1843, being universally accepted at the time Meek wrote, was one of the original syntypes of *Ammonites* (Bruguière) Meek, 1876, as Fischer correctly termed it. It was fixed by Hyatt's (1867) description of *Coroniceras bisulcatum*, quoting only d'Orbigny's figure, and by Meek's subsequent identification of *Coroniceras* with *Ammonites*, s. s.

It did not greatly matter, prior to the restriction of *Ammonites* in 1876, that the original *Amm. bisulcatus* of Bruguière was based on old and ambiguous figures. The syntypes, depicted in Lister and Lang respectively, were generally believed to be "*arietes*" of sorts; d'Orbigny, however, excluded Lister's figure from his synonymy and only quoted Lang (and Bourguet who copied Lang's figure). This only left one (inadequately figured) syntype, and in d'Orbigny's interpretation, with its excellent illustration, *Amm. bisulcatus* became for the first time a well-recognizable species.

Now Buckman (1924) objected that "Meek had said nothing at all of *Amm. bisulcatus* d'Orbigny," and that the latter was a bad imitation of Bruguière's *Amm. bisulcatus*. This is manifestly untrue and contrary to the ruling that an author must be assumed to have interpreted a species correctly. Buckman, indeed, went so far as to hazard

definite determinations of the ammonites figured by Lister and Lang, making the first a species of *Pleuroceras* (" *Paltoleuroceras* ") and identifying the second with *Amm. bucklandi* J. Sowerby. This may seem clear-cut and conclusive, but both the identifications (of what are at best unreliable figures) are unsupported by the conclusions of other observers; they are subject to differences of opinion and might well be suppressed by the Commission. Since Bruguière himself created a species (*Amm. spinatus*) for the very form that Buckman claimed to recognize in *Amm. bisulcatus* (as figured in Lister), he probably would have noted the resemblance as much as Buckman. Moreover, Bruguière commended Lister's figure as " *icon. bona* " of his *Amm. bisulcatus*, but not of his *Amm. spinatus*, which does not speak well for the likeness. D'Orbigny's *Amm. bisulcatus* belongs not only to a different genus but to a different family from Lister's alleged Middle Jurassic form, and would have to be renamed if Buckman's rejection of d'Orbigny's interpretation were upheld.

The reference of the other syntype (Lang's example from the Hartz Mountains) to *Amm. bucklandi* has been criticised before (Spath, 1924). The resemblance of Lang's figure (with especially badly drawn inner whorls) to the form depicted by Buckman (1919) as *Coroniceras bucklandi* may be entirely superficial; and Schmidt (1914) has nothing like it from the Harzburg Lower Lias. The identification with *Amm. bucklandi* is merely more guesswork, and while it is impossible, in the writer's opinion, to determine Lang's ammonite specifically, it may well be congeneric with d'Orbigny's much smaller *Amm. bisulcatus*. Buckman's attempt to substitute the meaningless *Ammonites*, s. l., of the end of the eighteenth century for the definite *Ammonites*, s. s., of 1876 is thus covered by Opinion 93, which condemns the changing of existing names without clear-cut necessity.

The writer proposes to submit to the International Commission a request to retain *Amm. bisulcatus* Bruguière, emend. d'Orbigny, 1843, as lectotype of the genus *Ammonites* (Bruguière) Meek, 1876. He claims that in so far as the original syntypes of *Ammonites* (Bruguière, 1789) Lamarck, 1801, are not definitely identifiable, they are unavailable, whereas d'Orbigny's unambiguous figure was not only one of Meek's syntypes of the substituted

genus *Ammonites* of 1876, but almost certainly his (undesigned) lectotype.

If this view be accepted, *Ammonites*, s. s., would cover a well-defined group of species, intermediate between *Epammonites* and *Megarietites*; in Buckman's interpretation *Ammonites* is restricted to the group of *Amm. bucklandi* of an earlier horizon, but on the basis of a doubtful, ancient figure. The most recent author to discuss the genotype of *Ammonites* Jaworski (1933) thought Buckman was right, according to the Rules; but he unquestioningly adopted Buckman's identifications of the old illustrations, while at the same time, he significantly referred to the genus as "*Ammonites* Bruguière, 1789, emend. Meek, 1876." Jaworski's remarks on the genotype of *Coroniceras* are equally uncritical, and, in any case, *C. coronaries* and *C. bucklandi* are congeneric, i. e., *Coroniceras* and *Ammonites* (in Jaworski) are identical. Buckman did take *C. coronaries* as the genotype in 1911, but Jaworski omitted to mention that previously (1898) Buckman had listed *C. rotiforme* and *C. bucklandi* as syntypes of *Coroniceras*. As the list was headed "in most cases the name which stands first may be considered as the type-species," I have always taken this to be a definite designation of *C. rotiforme* as the genotype of *Coroniceras*. For, though par. III i. of Art. 30 says that in selecting types authors should give preference to species of the same origin or meaning as the generic name (type by tautonymy), that is only a Recommendation and not a Rule (see also Spath, 1926). I propose to submit this minor point also to the Commission: fortunately it causes no practical difficulty since the three species mentioned are all congeneric.

In the same list, Buckman cited *Amm. turneri* as the genotype of *Arietites*, Waagen, 1869, in defiance of the Rules. Waagen definitely called *Amm. bucklandi* the most distinctive species of his genus, and though he did not actually use the word typical, its being the only specific name associated with the genus *Arietites* automatically made it the genotype. In 1911 Buckman again attempted to justify his selection of *Amm. turneri* (which he had called "merely a matter of arrangement"), but there can be no doubt that *Arietites*, 1869, is synonymous with *Coroniceras*, 1867.

Nor will it be possible to retain a "family" *Arietidae* as

was done, for instance, by Roman. But the latter author's work clearly shows how little stability there is as yet in the naming of these "arietid" genera, and it would be premature to claim suspension of the Rules by the Commission. The placing of *Ammonites* (with or without *Coroniceras*) in the Official List of Generic Names will be a first step in stabilising the nomenclature of the *Ammonitidæ*.

The elimination of *Arietites* (as emended by Buckman) would seem to leave the group of *Amm. turneri* without a generic name. Buckman himself used *Arietites* both for the early forms like *Amm. turneri* and *Amm. brooki* and for the later group of *Amm. tenellus* and *Amm. denotatus*, so that *Eparietites* Spath, created for these late forms, might seem to be available as a generic name. But the two groups must be kept apart; they are not connected by transitions, so far as is known, and they are derived from different ancestors. The *turneri* group originated in the *Arnioceratidæ*, while *Eparietites* is a post-*Asteroceras* development, tending towards *Oxynoticeratidæ*. Hyatt included all these forms of "*Arietites*" in the genus *Asteroceras*, the dominant ammonite stock of this *Asteroceran* Age (Buckman), so that the family name *Asteroceratidæ* seems the obvious choice, historically and systematically, in place of *Arietitidæ*, in the restricted sense. As generic name for the *turneri* group, Buckman's *Cænisites*, 1925, is available; for though it is based on a malformation, *C. cæneus*, the genotype and only example known, is only an individual variation of the common *Amm. plotti*, Reynès (1879), with deformed body-chamber. There is little doubt that Reynès's species and *Amm. turneri* are closely related; but as the typical genus of the family, *Cænisites* can scarcely compete with the well-known genus *Asteroceras*.

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XLVIII.—Description of a new Species of Asellus (Crustacea, Isopoda) from the Isle of Man. By WALTER E. COLLINGE, D.Sc., President of the Northern Ecological Association.

I AM indebted to the kindness of Mr. R. Wagstaffe, Keeper of the Yorkshire Museum, York, for a small collection of Asellids from Kirk Michael, Isle of Man. Amongst these

are numerous specimens of *Asellus aquaticus* (Linn.), a new variety of this species and also a new species.

This latter differs from *A. aquaticus* in the shape of the cephalon, the pleural plates of the mesosome, the metasomatic shield and the appendages of the uropoda. A striking feature is the colour-pattern on the shield.

One of the most striking characters of those Isopods contained in the freshwater genus *Asellus* (Geoffroy St. Hillaire) is the uniformity of the terminal portions of the pleura of the mesosomatic segments so typical has this been regarded that Sars * gives it as one of the generic characters. In by far the majority of species the terminal edge of this plate-like extension is truncate and similar in all the seven segments.

This description, while true for a large number of species is not correct for others, e. g., in *A. communis* Say †, the pleura of the 1st and 2nd segments are rounded terminally, while those of the 3rd-7th have a small hook-like projection on the anterior border, something similar occurs in *A. tomalensis* Harford on segments 4-7, and in the new species here described differences occur.

For some time past I have insisted that the form and disposition of these features were of far more importance than the number of spines and setæ on the appendages, and a much surer and safer criterion to employ to differentiate both genera and species, and the investigation of ample material fully bears out this contention.

Respecting the striking colour-pattern on the metasomatic shield, it is interesting to note that Ermin‡ has figured a specimen of *A. aquaticus* (fig. 11, c) in which the shield has somewhat similar, but very much fainter markings.

Asellus crypticus, nov.

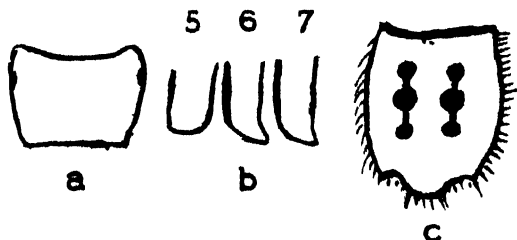
Body oblong oval, wider posteriorly. Cephalon broader than long. No lateral cephalic lobes. Frontal margin slightly excavate. Eyes small. Mesosomatic segments 1-5 with the pleura truncate terminally, those of 6 and 7

* 'Crust. Norway,' 1896, u p. 96.

† I am indebted to the kindness of Prof. Melville H. Hatch, of the University of Washington, Seattle, U.S.A., for examples of this interesting species.

‡ Rev. Fac. Sci. Univ. Istanbul, 1944, ix, p. 190.

are directed downwards and outwards, terminating in a hook-like point. Gnathopoda larger and more robust than in *A. aquaticus*. Metasomatic shield broad, setose, bluntly pointed on each side postero-laterally, terminally produced as a wide obtuse extension. Medio-dorsally slightly convex. Marked with two rows of dark brown circular patches, three in each row, of which the centre one



Aellus crypticus, nov

- a Dorsal view of the cephalon
- b Pleural plates of segments 5-7
- c Dorsal view of the metasomatic shield

is the largest, linked together. Uropoda with the basipodite broad distally and long, exopodite longer than the endopodite. Colour fuscous

Size 8.5 mm. ♂

Loc.—Kirk Michael, Isle of Man, 14. vi. 1945 (*R. Wagstaffe*).

Type.—In the author's collection.

XLIX.—*The Generic Name Pandora.*

By WILLIAM F. RAPP, Jr.*

THE 'Nomenclator Zoologicus,' vol. iii. p. 545, lists seven genera with the name *Pandora*. Of the seven, only three have been corrected.

The name *Pandora* is correctly applied only to a genus of marine shells. That is *Pandora* Chemnitz (Conchylien Cabinet. vol. xi. (1795), p. 211).

In 1829, Eschscholtz (Spst. Acalephen, p. 39) proposed the name *Pandora* for a genus of Ctenophores. According

* Contribution No. 251 from the Department of Entomology, University of Illinois, Urbana.

to Dr. Henry B. Bigelow, of the Museum of Comparative Zoology *, this name is still used ; therefore, I propose the new name *Novopandora* to replace *Pandora* Eschscholtz.

Haliday, in 1833 (Entomological Magazine, vol. i. p. 169), used *Pandora* for a genus of Diptera in the family Sepsiidae. In order to correct this homonym I propose the new name *Pseudopandora* to replace *Pandora* Haliday.

In 1834, Chevrolat (Dict. Univ. H. N. vol. iii. p. 656) used *Pandora* for a genus of Chrysomelidae (Coleoptera). Dejean recognized this homonym and in 1847 changed it to *Pandona* (Dict. Univ. H. N. vol. ix. p. 437).

Westwood, in 1848 (Gen. diur Lepidopt. (2) pl. xliii.), used the name *Pandora* for a genus of Lepidoptera. In 1883, Godman and Salvin recognized that *Pandora* was a homonym and proposed the name *Panacea*.

In 1850, Koch (Vebers Arachnidensyst, vol. v. p. 65) used *Pandora* for a genus of Arachnida. In order to correct this homonym I therefore proposed the name *Ultimopandora* to replace *Pandora* Koch.

The last zoologist to use *Pandora* was Sars (Bull. Acad. St. Petersburg (5) vol. iii. p. 287) in 1895, but he recognized his mistake and corrected it by proposing *Pandorites* in the last of the paper.

I wish to thank Dr. Henry B. Bigelow, Museum of Comparative Zoology, Dr. Willis J. Gertsch, American Museum of Natural History, and Dr. Harold A. Rehder, United States National Museum, for the help they have given me. Miss Nadine C. Banister and Mr. Lyle E. Bamber, of the Natural History Library of the University of Illinois, have been a great help in finding many of the references.

ERRATA.

(Ann. & Mag. Nat. Hist. vol. xi. 1944.)

P. 670, line 1 for *Trogophloeus minimus* read *minus*.

P. 718, line 4 from bottom for *Tachyusia* read *Tachyus*.

P. 783, line 21 for *Paraxantholinus* read *Pseudozantholinus*.

P. 784, line 13 for " " "

* In a personal communication.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 92. AUGUST 1945.

L. A new Calanoid Copepod from Australia. By A. G.
NICHOLLS, Ph.D., University of Western Australia.

THE Copepod, which forms the subject of this contribution, was sent to me for identification by Mr. J. M. Thomson, of the Fisheries Division of the Council for Scientific and Industrial Research, at Cronulla, New South Wales.

It was collected from the mouth of the Georges River, which discharges into Botany Bay, and is an important constituent of the plankton of the "conflict" zone, where the river water enters the sea. The following notes have been supplied by Mr. Thomson. - "The 'conflict' zone is, during most months of the year, subject to considerable fluctuations in salinity, with a peak on every high tide. The specimens forwarded were taken at about three-quarter ebb, when the salinity was about a quarter that of the open sea. Later in the year, from June to August, the 'conflict' zone moves downstream owing to the weight of flood waters upstream, and hauls taken in the same spot during these months failed to reveal the species." The specimens sent to me were collected during May 1945. It is apparent, therefore, that this copepod is a euryhaline species, probably with a restricted distribution*. It is the only numerous organism in the plankton at the time of year when it first appears. It is to be hoped that we shall learn more of its biology when Mr. Thomson completes the investigation of the plankton

* See supplementary note at end.

of the Georges River system, upon which he is now engaged.

I am indebted to Dr. H. Thompson, Chief of the Division, and to Mr. J. M. Thomson, for the opportunity of describing this interesting copepod.

Sulcanus conflictus, gen. et sp. nov.

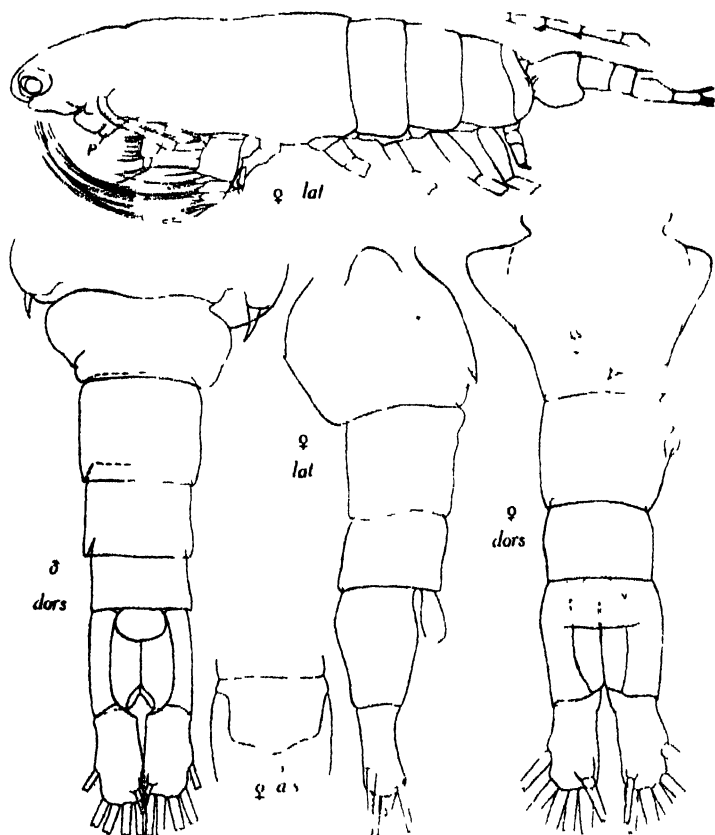
Female.—Length: 1.4 to 1.6 mm.

The "cephalosome" constitutes half of the total body length, and includes the somite of the first legs; this is followed by four free segments, bearing the second to fifth pairs of legs. The last segment is the smallest, and is distinctly separated from the preceding segment. It bears a backwardly directed spine on each side, and these may be slightly asymmetrical. The urosome is four-segmented, of which the first is the largest and is asymmetrically expanded into flattened, wing-like processes anteriorly, in the dorso-lateral region of the segment. A single, pointed process is situated dorsally in the mid-line, near the hind margin. The second segment is unevenly sculptured on the right side only, the left margin being entire. The third segment is the shortest. The anal segment shows a peculiar structure in that it bears a large anal process which may or may not extend beyond the middle of the segment; that portion of the segment distal to this anal operculum is deeply excavated to form a longitudinal furrow occupying about one-third of the total width of the segment. The anal cleft extends to near the anterior margin of the segment. The anal operculum is not clearly delineated in all specimens; the condition seen in two females is shown in fig. 1 (♀ *dors.* and ♀ *a.s.*), but the detailed structure of this region is difficult to make out. The caudal rami are slightly shorter than the anal segment, and are almost symmetrical; the terminal setæ are a little longer than the urosome.

The head (figs. 1 and 2) is characterized by the prominent eye, the multi-lobed labrum, and the unusually long setæ on some of its appendages. The eye is conspicuous, and is deeply pigmented with red, in some specimens, in those portions indicated by stippling (fig. 4 *e*); in some cases the red pigment is found all through the eye. It is composed of three separate ocelli, two lying side by

side and dorsal to the third, which is larger and more conspicuously coloured. The labrum (figs. 1 and 2) consists of the usual sub-rectangular plate lying across

Fig. 1.



Female from the left side, with end portion of antennule in position *p.*, paragnath ($\times 60$). Urosome of female from above and from left side ($\times 178$); and last thoracic segment and urosome of male, from above ($\times 178$). The anal region of another female is also shown (*a. s.*).

the body anterior to the mouth, with paired lobes laterally, lying dorsal to the main structure; anteriorly it is continued as an elongate lobe which extends forwards to end

beneath the eye. In some specimens this anterior lobe has a clear central portion, giving the appearance of a cavity. The paired paragnaths (*P*) lie immediately behind, and in contact with, the hind margin of the labrum, ventral to the mandibles.

The antennules (figs. 1 and 3) are symmetrical and extend to about the middle of the anal segment. They consist of sixteen free segments, but the full number of twenty-five can be distinguished. Fusion has occurred

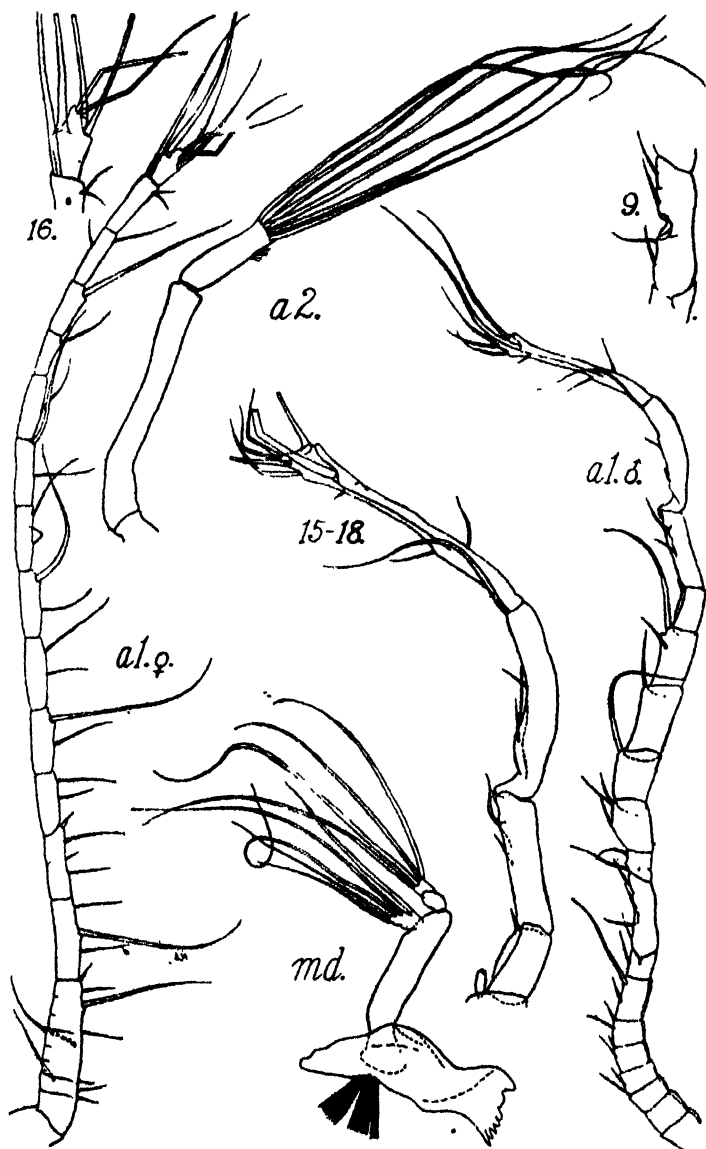
Fig. 2.



Head of female from below, showing lobed labrum, mandibles and paragnaths (*P*), ($\times 124$).

within the first thirteen segments, so that they appear as four free segments; the first segment is free, segments two to nine form the second segment, segments ten and eleven form the third, and segments twelve and thirteen form the fourth free segment; these are followed by twelve free segments. This fusion is not always to be seen, and sometimes segments one to nine are as clearly defined as in the male; in this respect a certain amount of asymmetry may be noted. The tubercular processes

Fig. 3.

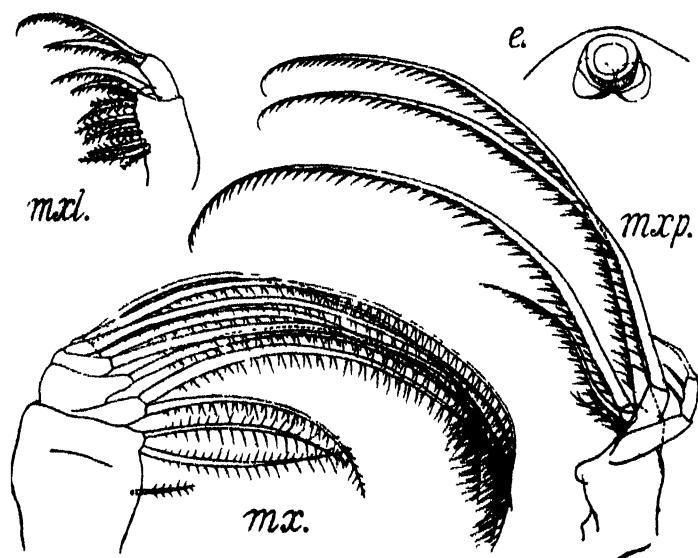


Right antennule (a. 1) of female and of male ($\times 100$), with separate portions of these on a larger scale ($\times 165$); the numbers refer to the distinct segments in each case. Second antenna (a. 2) and mandible (md.) ($\times 165$).

at the bases of the large setæ are reminiscent of the condition in *Acartia*.

The second antennæ (figs. 1, 2 and 3) are slender, elongate, two-segmented appendages, without trace of an exopod. The basal segment is unarmed, and the distal segment bears six long terminal setæ, longer than the whole appendage, and a row of short hairs. When directed backwards the appendage reaches to the anterior margin of the maxilla (fig. 1).

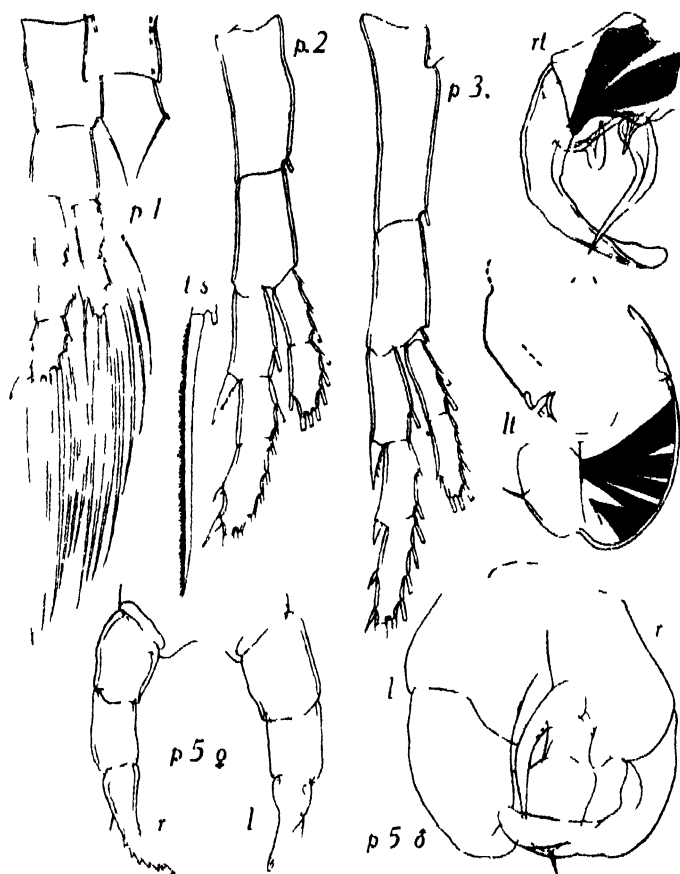
Fig. 4.



Maxillule (*mxl.*), maxilla (*mx.*), maxilliped (*mxp.*), and eye (*e.*) (all $\times 165$). The maxilliped was drawn from a male.

The mandible (fig. 3) has a well-developed gnathobase, with prominent teeth; the palp has a long basipod, bearing a one-segmented exopod distally, and a two-segmented endopod terminally. The exopod appears to be four-segmented, but no transverse lines separating the segments could be made out; it bears three lateral, and two terminal setæ, all relatively long. The basal segment of the endopod is unarmed, and the distal segment bears four long, terminal setæ.

Fig 5



First, second, and third legs (*p* 1-3) of the female, with the outer terminal seta (*ts*) of the exopod of the second leg *p* 5, fifth legs of female, drawn from in front, and of the male, drawn from behind, *rt* and *lt* indicate the right and left legs respectively of another male, in which the legs have been separated, and drawn from in front. The left leg was slightly damaged in the process of dissection, as shown by the break on the inner margin of the basal segment (All 219)

The maxillule (fig. 4) consists of a large basal segment, armed on its inner margin with a number of stout, denticulate spines, and a smaller distal segment bearing two long, curved, similar spines, and a small accessory seta.

The maxilla (figs. 1 and 4) is five- or perhaps six-segmented, and bears unusually long, strong, denticulate spines, which reach forward as far as the eye.

The maxilliped (fig. 4) is, perhaps, the most striking of the unusual features of this Calanoid. It has the appearance of being biramous, but comparison with those of *Acartia*, *Tortanus* and *Parapontella* shows that the reduction of the terminal portion, and lateral expansion of the proximal portion, found in *Acartia*, have proceeded to a degree even further than that found in *Tortanus* and in *Parapontella*. The apparent segmentation of the proximal portion is due to the sheath-like expansion of the bases of the very long, denticulate spines, with which it is armed, and which appear to be wrapped around the lateral extension of the segment, at the point of their insertion. These setae, like those of the maxilla, reach to the front of the labrum.

The swimming-legs (fig. 5) increase in length from the first to third pairs, the coxal segment showing the greatest increase, but all the segments participating to a greater or less extent. The fourth pair is exactly similar to the third, except for a difference of one seta on the endopod. In all four pairs the exopod is three-segmented, but the armature of the outer margin varies. In the first leg the first two segments are unarmed, and the third segment bears two stout spines; in the second leg the first segment bears a strong distal spine, with four minute denticles on its inner margin, the second segment is unarmed, and the third segment bears two, unequal, marginal spines; in the third and fourth pairs the first two segments bear each one spine, and the third segment bears two. In the first two pairs of legs the endopods are two-segmented, and in the third and fourth pairs they are three-segmented; the basal segment of the latter is very small, and the line of separation very indistinct. The armature of the basal segment of this ramus in the first and second legs shows that it is actually composed of two, fused segments.

The seta formula for legs one to four is as follows :—

			endopod	exopod
leg 1	..	..	3 . 321	1 . 1 . 322
leg 2	..	..	3 . 421	1 . 1 . 422
leg 3	..	..	1 . 2 . 421	1 . 1 . 422
leg 4	..	..	1 . 2 . 321	1 . 1 . 422

With the exception of the outer terminal seta of the exopods all the setae appear to be naked. The coxa bears an inner basal seta, but the basipod is unarmed. The armature of the outer margins of the exopods is strikingly reminiscent of the condition in the genus *Tortanus*.

The fifth legs (fig. 5) also resemble those of *Tortanus*, rather than those of *Parapontella* or *Acartia*. They are uniramous, and three-segmented, the terminal segment being spur-like, and asymmetrical, the right having a serrated outer margin. They are more reduced than those of *Parapontella*, which retains a one segmented endopod, but less so than those of *Tortanus*, which are never more than two-segmented, or of *Acartia*, which show still greater reduction.

Male.—Length: 1.5 to 1.6 mm.

In the segmentation of the anterior region the male resembles the female. It differs in having a five-segmented urosome, the right antennule modified for grasping, and in the structure of the highly modified fifth pair of legs.

The first segment of the urosome is short and wide, and is slightly asymmetrical. The anal segment, in the specimen figured here (fig. 1), showed a well-defined anal operculum, ovoid in outline when viewed from above. The dorsal excavation of this segment was clearly marked and extends to the base of the caudal rami. These are slightly asymmetrical in the male, the left being somewhat longer than the right, and sometimes the setae of the right ramus are considerably reduced.

The right antennule (fig. 3) is composed of eighteen free segments, but, as was the case with the female, more can be distinguished. The seventh segment is probably composed of two fused segments, the ninth appears to contain four segments, and the tenth to contain two segments, while the small terminal segment is fused with the preceding segment, making a total of twenty-four

segments. The hinge is situated between the sixteenth and seventeenth free segments, leaving two distinct segments in the terminal portion.

The segmentation and armature of the swimming-legs are identical with those of the female. The fifth legs (fig. 5) are large, and asymmetrical. They are composed of a large basal part, containing the fused coxa and basis, those of opposite sides being coalesced, but a line of separation is partially defined by a median suture, which does not extend to the base of the appendage. In the right leg the exopod is one-segmented, and tapers to end in a flattened, rounded, spoon-shaped process, which is comparatively thin, and hyaline. Adjacent to the base of the exopod is a small, inner, rounded process, which does not appear to be articulated. Adjacent to this process is a long, curved, spine-like process, articulated at its base, and apparently used in conjunction with the outer ramus in transferring the spermatophore; this may represent the endopod. Slightly anterior to this process is a well-developed spine, which probably represents the inner coxal seta of the swimming legs. The left leg is more solidly built and is uniramous. The line of separation of the ramus is not always clearly marked or continuous. This ramus is partially divided into two portions by a suture across the narrow part, but which does not extend to the outer margin. The well-developed muscles in this region would suggest that the end portion is capable of a hinging movement upon the proximal portion. The end part is roughly ovoid in outline, and bears a single small seta on its outer margin*. From the point of insertion of this seta a line runs across the segment, distal to which it is thin and hyaline, similar to the end of the exopod of the right leg. The distal extremity of the left leg meets the rounded process of the right leg, described above.

The male fifth legs, although at first sight resembling those of *Tortanus*, are clearly related to those of *Parapontella*, particularly in the retention of the articulated spine on the right leg, which in both genera appears to be the remains of an endopod. The inclusion of the basal segment of the exopod of *Parapontella* in the fused coxa and basis would bring about the condition found in *Sulcanus*, and account for the spur adjacent to the base

* See supplementary note at end.

of the exopod, already developed in *Parapontella*. At the same time, the left leg has undergone some modification, including the suppression of distinct segmentation.

Diagnosis of the Genus.

In so far as it is possible to present a generic diagnosis based on one species, I have selected below those characters, by the combination of which this genus is to be distinguished from members of allied families.

Head fused with somite bearing the first legs, somites of fourth and fifth legs separated in both sexes, urosome four-segmented in the female, five-segmented in the male. Head without lateral hooks, eye prominent, without cuticular lenses; rostrum absent; labrum prominent, with accessory lobes. Last segment of the thorax rounded, with posterior spines, almost symmetrical in both sexes. First segment of the urosome enlarged and asymmetrical in both sexes, particularly in the female. Caudal rami symmetrical in the female, somewhat asymmetrical in the male, the right being the longer and wider. Anal segment cleft almost to the base, dorsally excavated, and overhung by the large anal operculum.

First antennae in the female with the segments more or less fused, and with tubercles at the bases of the large setae; right antennule in the male with eighteen distinct segments, and modified for grasping. Second antenna uniramous, two-segmented, elongate, with a terminal bunch of long setae; an exopod lacking. Mandible palp biramous; exopod subterminal, unsegmented; endopod terminal, two-segmented. Maxillule and maxilla with reduced segmentation, but strongly armed with long, curved, denticulate spines. Maxilliped with basal portion enlarged, extending beyond the base of the distal portion, and bearing very long, strong, curved, denticulate spines; terminal portion reduced, two-segmented.

Basipods of the swimming-legs increasing in length from first to third pairs, exopods three-segmented, endopods two-segmented in first and second pairs, three-segmented in third and fourth pairs; both rami armed with long setae. Fifth legs uniramous, three-segmented, somewhat asymmetrical, in the female; left leg uniramous, right biramous, both strongly modified, in the male.

Affinities.

This genus resembles *Acartia* in its general appearance, in the first antennæ, and in the possession of a lobed labrum; it differs from that genus in practically every other feature. It resembles *Tortanus* in the lack of a rostrum, in the prominent eye, the appearance of the labrum, first antennæ, mandible palp, maxillule, and, to a certain extent, in the legs, including the fifth pair of both sexes. It differs from that genus most noticeably in the uniramous second antennæ, the maxilliped, the segmentation of the urosome, and the lack of marked asymmetry in the anal region.

The presence of free fourth and fifth thoracic segments is a further link with *Tortanus*, but the four-segmented abdomen distinguishes it from that genus, in which it is either two- or three-segmented. Sewell (1932, p. 398) used the condition of the last two thoracic segments as one of the characters separating the genus into two subgenera. It would appear that this may not be a valid character, since, from the evidence supplied by Steuer (1926), these segments may be free in the female and fused in the male of the same species (*gracilis*). Moreover, Sewell's revision omits from consideration the two North American species which comprised Steuer's "Group I," one of which possesses characters which unite the two subgenera proposed by Sewell. Steuer divided the genus into three groups.

The possession of the peculiar lobed labrum is shared not only with the members of the Acartiidæ and Tortanidæ, but also with the Pontellidæ, and related families. The nearest approach to the condition of the maxilliped is found in *Parapontella* (see Sars, 1903, pl. xeviii.), but in many other features it differs strikingly from members of that family, showing a much greater reduction in most of the mouth-parts. The striking development of the eye is, also, a feature common to this group of Calanoids.

The peculiar condition of the anal segment is a development of the condition found in *Neopontella* A. Scott (1909, p. 185, pl. lv.), and the triple eye is reminiscent of *Parapontella*. The third member of the Parapontellidæ, *Bathypontia*, a species of which was described by A. Scott (*op. cit.*, p. 182, pl. iii.), is less specialized in regard to the modification of the fifth legs of the male, but those

of the female are very similar to the condition described for *Sulcanus*. The segmentation of the swimming-legs, and to a certain extent their armature, resembles that of *Bathypontia*, since the basal segment of the endopod is free in the posterior pairs. In both *Neopontella* and *Parapontella* this segment is fused with the second segment in all but the first pair. Further affinity with the Parapontellidae is shown by the segmentation of the abdomen.

I regard this genus as representing a new family, derived from the Parapontellidae by reduction and specialization, and somewhat closer to the Tortanidae, but not having undergone the reduction found in that family. Its most outstanding features are: the uniramous second antenna, with its greatly elongated segments; the very long setae throughout, but particularly in the maxilla and maxilliped; and the peculiar condition of the anal region. The generic name refers to the last of these peculiarities.

Supplementary Note.

Since the above account was written, a form has been found in a sample of plankton taken from the estuary of the Swan River, Western Australia, at the end of September of this year, which is practically indistinguishable from that described above. The chief differences shown are in the first antennae, which reach to just beyond the end of the caudal rami, and in the basal segment of the endopod of the first leg, which appears to have only two inner setae instead of three. The size range for the females is 1.5–1.7 mm., and for the males 1.4–1.6 mm. It is doubtful if these differences are sufficient to warrant a new species, and probably constitute little more than a local variety.

The left leg of the fifth pair in the male shows two additional small setae, one on each side of the outer distal marginal invagination. These are also present in the material from New South Wales, and although both of them were omitted from the detailed figure of the left leg (fig. 5, *l*), the more distal is shown in the figure of the posterior view of these legs (fig. 5, *p. 5. ♂*). The proximal seta is inserted on the crest of the rounded portion of the outer margin, proximal to the invagination, and the two setae are practically equidistant from the centre of the depression.

A further point of interest, which was noted in the local material, is the presence of a pair of minute setae projecting from the ventral surface of the head, in line with the anterior margin of the eye. These may represent the vestiges of a rostrum.

The occurrence of this species in Western Australia is of considerable interest, in view of the fact that both here and in New South Wales it is associated with a species of *Gladioferens*. The latter has been described only from Australasian waters, and is found in coastal lakes, of varying salinity, but is occasionally taken in marine plankton. Whereas the species of *Gladioferens* differ from place to place around the coast of Australia, the associated genus *Sulcunus* is represented by a single species from places as widely separated as Botany Bay and the Swan River. In view of its being a purely estuarine form its distribution may indicate a great antiquity for this genus.

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LI.—*Descriptions and Records of Bees.*—CC.

By T. D. A. COCKERELL, University of Colorado.

Halictus griseocinctus, sp. n

♂.—Length about 5.5 mm., anterior wing about 4 mm.; black, the clypeus all black, the mandibles red except at base, flagellum red beneath, legs black, with the small joints of tarsi dusky red; pubescence very scanty; head about circular seen from in front; clypeus produced, highly polished; supraclypeal area presenting a small shining spot; mesonotum entirely dull; scutellum with two moderately shining elevations; postscutellum with a broadly triangular area of greyish tomentum; area of

metathorax rather large, shining, with strong plicæ on basal part; sides of thorax with little hair; tegulæ shining black, perhaps faintly brownish; wings dusky hyaline, stigma pale brown, nervures pale, second submarginal cell narrow, receiving recurrent nervure at apical corner; abdomen stout and rather short, shining, the third tergite with a rather broad entire band of greyish tomentum at base.

Uganda: Kampala, Nov. 17, 1915 (C. C. Gowdey, 3980).

Compared with *H. gossypiellus* Ckll., this is considerably smaller, the nervures are much paler, and the area of metathorax is quite different. *H. nigrtellus* Ckll., from Tshilinda, has no hair at bases of tergites, and area of metathorax different. *H. nigritulinus* Ckll., also from Kampala, is much smaller and less robust.

Halictus boswendiellus, sp. n.

♂. Length about 5.5 mm., anterior wing 5: black, including antennæ and legs; pubescence white, but very scanty; head broader than long; clypeus very short, with a median groove and strong punctures. supraclypeal area moderately shining; mandibles black; galea broad and polished; antennæ only moderately long for a male, flagellum thick; mesonotum, scutellum and postscutellum entirely dull; area of metathorax small, shining, with very strong plicæ; tegula black; wings dusky apically; stigma and nervures very dark brown, outer nervures not weakened; second submarginal cell rather narrow, receiving recurrent nervure at apical corner; third submarginal produced apically; legs slender, the hind tarsi very long; abdomen shining black, without bands; small obscure spots of hair at lateral bases of second and third tergites; apical plate large, dark reddish.

Belgian Congo: Boswenda, near Burunga, alt. 1900 m., Oct. 22, 1914 (J. Bequaert). A peculiar little species, with slender legs and very ample wings. It may be compared with *H. kasuloi* Ckll., from Tshilinda, but that has the mesonotum polished, and extremely long antennæ. *H. nigrtellus* Ckll., also from Tshilinda, is also similar, and does have a dull mesonotum, but it differs in several respects, as in the presence of a shining elevation on the underside of abdomen.

Halictus burungicohus, sp. n.

♀.—Length about 6.5 mm., anterior wing 5; similar in many respects to *H. boswendiiellus*, with the same black colour and entirely dark legs, the same broad shining galea (the maxillary palpi are long and slender), the same wings with dusky apical region, but it differs conspicuously thus: head broad-oval, clypeus large, shining, supraclypeal area highly polished; mesonotum polished, scutellum shining, but dull in middle; area of metathorax large, dull, with a rounded shining margin, not plicate; the abdomen is shining black, without hair-spots or bands. Stigma very large, dark brown.

Belgian Congo: Burunga, 1° 30' S., 29° 18' E. (*J. Bequaert*). The type has collected a quantity of orange pollen on the basal part of the hind legs. A close relative is *H. ruwenzicus* Ckll., from Mt. Ruwenzori, but that has the wings quite differently coloured, and the stigma lighter and redder.

The following table separates three species from Burunga, Belgian Congo, collected by J. Bequaert:

Area of metathorax a narrow band; mesonotum polished	<i>lateronitens</i> Ckll.
Area of metathorax large	1.
1. Mesonotum polished	<i>burungicohus</i> Ckll.
Mesonotum dull, somewhat shining on disc; hind femora with a very large pure white scape (abdomen missing)	sp. n.

Halictus macrozonops, sp. n.

♀.—Length about 9 mm., anterior wing 6.3; black, the very broad abdomen with very broad pale marginal depressions on tergites 2 and 3, and a narrower one on 4, these depressions pale yellowish, flushed with red basally; pubescence dull white, short and thin on thorax above, dense and white at sides of face, postscutellum with dull white tomentum on basal half; head broad, mandibles and antennæ black; clypeus shining apically, but with a broad dull band across the middle; supraclypeal area large, appearing dull seen from in front, shining seen from the sides; mesonotum distinctly punctured, moderately shining but not polished; scutellum dull, with two shining elevations; area of metathorax very short, finely rugose; metathorax posteriorly with long hair; tegulæ very dark

brown; wings yellowish, stigma and nervures dusky red, outer nervures weakened; second submarginal cell very broad; first recurrent nervure meeting intercubitus; third submarginal cell strongly bulging outwardly; legs with tarsi red; hind spur with many short spines; abdomen mainly dull, the sternites hairy, but no hair-bands above.

Katanga: Lubumbashi, May 12, 1921 (*Michael Bequaert*). This may be compared with the South African *H. macrozonius* Ckll., but that differs by the entirely shining clypeus, the character of the area of metathorax, the testaceous tegulæ, and other characters. *H. moshiensis* Ckll. differs by the partly red abdomen.

Halictus chiromensis, sp. n.

♂. —Length about 9 mm., anterior wing 7.8 mm.; black, the clypeus with a light yellow transverse band, and the tarsi clear red at apex, pubescence white, rather scanty, but abundant on sides of face and on front, postscutellum with a band of dense slightly yellowish tomentum; head broad; antennæ broken in type, but what is left shows the flagellum dull red beneath; mesonotum entirely dull, not bordered with hair at sides or behind; scutellum with two faintly shining elevations; area of metathorax large, entirely dull, without evident plicæ, abdomen long and parallel sided, dull, but hind margins of tergites shining; continuous greyish-white hair-bands at bases of second and third tergites; apical plate dark; the first tergite has erect pale hair at base; tegulæ red, wings with apex conspicuously dusky; stigma and nervures dark brown, outer nervures not weakened; second submarginal cell very broad, receiving recurrent nervure a short distance from end; third submarginal cell broad, but little bulging at apex.

Nyasaland: Chiromo (*R. C. Wood*, 1859). *H. alopex* Ckll., from Tshilinda, has the thorax above with bright fox-red hair; *H. flavolineatus* Ckll., from near Uviro, is much smaller, with an entirely different metathorax. *H. patriciformis* Ckll. does not have hair-bands on abdomen and has black tegulæ.

Halictus masisiellus, sp. n.

♀. —Length about 6.4 mm., anterior wing 4.6; black, the abdomen without bands, but hind margins of tergites

rufescent; head broad-oval; mandibles very faintly brownish apically; clypeus and supraclypeal area polished, the clypeus with a median groove; front shining but not polished; vertex polished; antennæ black, the scape long, the claviform flagellum faintly brownish beneath; pubescence white, very scanty, not forming a patch on postscutellum; mesonotum and scutellum polished; area of metathorax large, dull, not plicate, with a narrow shining margin; tegulæ very dark brown; wings dusky, stigma and nervures brown, outer nervures weakened; legs entirely dark, hind tibiæ and tarsi conspicuously hairy; abdomen shining, narrowed basally.

Belgian Congo: Masisi, 1 S., 28° 30' E., Dec. 30, 1914 (J. Bequaert).

Resembles *H. burungicolus* Ckll., but has a much broader face, and the area of metathorax is larger and dull, with the shining margin hardly at all visible when seen from behind. The wings are not so dark, and the outer nervures are weaker. *H. ruwenzicus* Ckll. has weakened outer nervures but the abdomen is fusiform and much narrower, and the head is narrower. *H. boswendiellus* Ckll., has strong outer nervures, and the area of metathorax strongly and densely striate.

H. masisiensis Ckll., described from the male, is much smaller, with a much smaller abdomen, but it is possible that it is the male of *H. masisiellus*.

Halictus recessus (Cockerell).

Katanga: Lubumbashi, March 12 and 22, 1921 (Michael Bequaert).

This was described as a subspecies of *H. shanganiensis* Ckll., but it holds its characters well, and should probably be regarded as a species.

Halictus epichlorops, sp. n.

♀.—Length about 4.5 mm., anterior wing 4; head and thorax pure black, but abdomen with an obscure olive-green tint; mandibles black; flagellum faintly reddish beneath; clypeus and supraclypeal area shining, a narrow shining line along orbits; mesonotum dull, moderately shining on disc; scutellum small, with two shining points;

postscutellum not covered with tomentum ; area of metathorax large, with a broad shining margin, the microscope shows the area to be very minutely tersellate, with a series of short basal plicæ ; tegulæ very dark brown ; wings clear ; stigma light reddish with a dark margin ; nervures brown, outer nervures weakened ; second submarginal cell rather narrow ; first recurrent nervure interstitial, or reaching extreme base of third submarginal cell ; third submarginal cell broader on marginal than second ; legs black ; abdomen shining, with bands of greyish tomentum at bases of second and following tergites, that on second narrow, that on third broader.

Belgian Congo (Katanga) : Lubumbashi, Feb. 8, 1921 (*Michaël Bequaert*). I thought at first this might be *H. epichlorus* Ckll., which is a variable species, but the banded abdomen and the details of the venation are distinctive. There is a general resemblance to the South African *H. dispositellus* Ckll.

Two other specimens of *H. epichlorus* were taken at Lubumbashi, Feb. 23 and June 28. They appear to be larger, one quite 5.5 mm., but this is mainly or wholly due to the extension of the abdomen.

Halictus viridibasis, sp. n.

♂. —Length nearly 5 mm., anterior wing hardly 4 ; head and thorax dark bluish green, abdomen black, with the first tergite nearly all green, and the depressed bases of second and third tergites green ; head large, broader than thorax ; mandibles largely pale yellow ; clypeus with a yellow apical band ; antennæ long, the flagellum broadly yellow beneath ; hair of head and thorax thin, white ; mesonotum and scutellum shining ; area of metathorax rather small, dull, the margin somewhat shining ; tegulæ small, almost colourless ; wings perfectly clear, stigma pale yellow ; second cubital cell broad, receiving first recurrent nervure at apex ; anterior tibiæ in front, the others at base and apex, and all the tarsi pale yellow ; abdomen small, without hair-bands.

Cape Province : Mossel Bay, Jan. 1922 (*R. E. Turner*).

Apparently related to *H. thestis* Cam., but not so small, and the green colour is distinctive. There is also some suggestion of *H. centrosus* Vachal, from tropical Africa.

Halictus chloropinus, sp. n.

♂.—Length about 5.5 mm., anterior wing about 4.5; head, thorax and abdomen green, not brassy, pubescence pure white, rather abundant; eyes green; clypeus projecting, with a broad apical yellow band, mandibles partly pale; antennæ rather long, the flagellum light red, dusky above; scutellum and disc of mesonotum polished. scutellum with no median depression, area of metathorax rather short, dull, with a shining margin; tegulæ small and pale, wings clear hyaline, somewhat milky, stigma very pale yellowish; second submarginal cell receiving recurrent nervure well before end, front tibiæ, and all the tarsi, light yellow, middle and hind tibiæ hairy, and largely dark, abdomen shining, with rather narrow apical hair-bands on tergites.

S. W. Africa: Aus, Dec. 1929 (*R. E. Turner*). Related to *H. austrovagens* Ckll., and perhaps not more than a desert race. It is, however, distinctly larger, and of a different shade of green.

Halictus kavirondicus, sp. n.

♀.—Length nearly 10 mm., anterior wing 7.5; rather narrow, black, the first four tergites of abdomen with rather broad ochreous-tinted tegumentary bands; head broad; anterior part of clypeus shining; scape long, flagellum very faintly brownish beneath; hair of head and thorax abundant, dull whitish, slightly fulvous on thorax above, but not brightly coloured on scutellum; mesonotum and scutellum dull; area of metathorax large, dull, not plicate, with a rounded shining margin; tegulæ pale testaceous; wings dusky but not very dark; stigma ferruginous; second submarginal cell broad, somewhat narrowed above, receiving first recurrent nervure far from end; legs black, with pale reddish hair, middle and hind tarsi red; abdomen moderately shining, with thin hair, but no hair-bands; fifth tergite densely covered with pale hair. On the inner side the hind tibiæ are red at base and apex; the hind spur is coarsely serrate, but not pectinate.

British E. Africa: Upper Kuja Valley, S. Kavirondo, 4200 ft., May 5-8, 1911 (*S. A. Neave*). Allied to *H. tinctulus* Ckll., but considerably larger, yet not so large as *H. subpatricius* Strand. The red tarsi are suggestive of *H. vittatus* Smith,

There are also two specimens of *H. kavirondicus* from Mabira, Uganda, Aug. 16, 1925 (G. L. R. Hancock) and Sept. 18, 1910 (C. C. Gowdey).

The hind spur resembles that of *H. albofasciatus* Smith.

A specimen from Zala, Uganda, Dec. 13, 1926 (G. L. R. Hancock) agrees in size with *H. tinctulus*, but has the abdominal bands creamy white. It is certainly distinct from *H. tinctulus* and *H. kavirondicus*, but I believe it can be referred to *H. nomioides* Friese, as a variety.

Halictus viridiflorus, sp. n.

♀.—Length about 7 mm., anterior wing nearly 6; black, with linear green tegumentary bands on margins of first four tergites; head broad; clypeus and supraclypeal area moderately shining; no shining band along orbits; mandibles and antennæ black, the flagellum obscurely reddish beneath toward end; pubescence very scanty, not thick even on ploura, but tubercles with a white fringe; mesonotum dull, moderately shining on disc; scutellum shining at base; area of metathorax not plicate, the rounded margin not interrupted; tegulæ dark brown; wings dusky; stigma dark brown; nervures rather pale; second submarginal cell broad, receiving recurrent nervure a considerable distance from end; legs black; scape of hind legs strongly developed; abdomen shining, without hairbands or spots.

Uganda: between Seziwa and Kampala, 3500–3750 ft. alt., Aug. 27–31, 1911 (S. A. Neave). By reason of the green bands, this resembles *H. nomioides* Friese, but that has the bands much broader. The closest affinity is with *H. andersoni* Ckll., which has a broader face, clearer wings, and a larger area of metathorax. It is possible that they are only subspecifically distinct.

Halictus ugandicus, sp. n.

♂.—Length about 7.5 mm., anterior wing 6.5; black, including clypeus, mandibles, tegulæ and legs; the long flagellum obscurely brownish beneath; labrum with a fringe of pale reddish hair; clypeus produced, with a strong median groove; the clypeus is moderately shining, but the supraclypeal area wholly dull; front dull, with no shining line along orbits; pubescence white, abundant on

sides of thorax and on tubercles; mesonotum and scutellum dull, faintly shining on disc; postscutellum not densely hairy; area of metathorax short, with strong well separated plicæ; wings dusky; stigma rather small, dusky reddish; nervures dark: second submarginal cell rather broad, receiving recurrent nervure at extreme end; front and middle tibiæ with a strong fringe of white hair; abdomen broad and very short: first tergite without lateral hair-spots; second with an entire basal band of white hair, narrow in middle, broad at sides; third with an interrupted band; apical plate dark, with a sharp tooth on each side of it.

Uganda: Entebbe, March 15, 1913 (C. C. Gowdey No. 3158).

I had at first taken this for *H. nairobiensis* Ckll., which also has lateral teeth at end of abdomen, but is smaller, with a broad hair-band at base of third tergite, spots at sides of first tergite, and shorter antennæ.

H. nairobicus Ckll. differs, among other things, by the narrow border of hair at sides and hind margin of mesonotum.

The five species of male *Halictus* seen from Uganda all have the clypeus entirely black.

Halictus zonaturus, sp. n.

♀.—Length about 8 mm., anterior wing 6: black, with white hair, sparse on face, abundant on sides of thorax; head broad-oval; tongue not elongated; mandibles and antennæ black; tegulæ very dark brown; clypeus moderately shining, especially the lower margin; supra-clypeal area shining; mesonotum moderately shining, but closely punctured; scutellum highly polished; postscutellum basally with white pubescence; area of metathorax coarsely rugose, with distinct plicæ at sides; wings hyaline, very faintly dusky; stigma dark brown, not very large; nervures dark brown, outer nervures weakened; second submarginal cell very broad; recurrent nervure meeting intercubitus; third submarginal unusually short; legs black, with tarsi reddened at apex; the hind legs have collected pale pink pollen; hind spur with three short stout spines, the first far from bare; abdomen shining; first tergite with patches of hair at extreme sides; second with a rather broad, entire, basal

band ; third with a broader one, fourth also with a basal band ; apex with white hair, but region of caudal furrow dark.

Uganda Entebbe, Oct. 8, 1909 (*C. C. Gowdey*—No. 788).

All the bees described above are the property of the British Museum.

LII. —On *Nautilus libanoticus* Foord and Crick, in the Senonian of Palestine. By MOSHÉ AVNIMELECH, Hebrew University, Jerusalem.

I. PREFACE.

MORE than fifty years ago A. H. Foord and G. C. Crick published in this periodical a note on *Nautilus libanoticus* (6), and a year later the same *Nautilus* was also described and figured by Foord in his 'Catalogue of the Fossil Cephalopoda' in the British Museum (4). Since then, this species has not been described or figured, although the material on which the original diagnosis was based was of a rather poor quality.

Some years ago, while making a geological survey in the Shephela region in Palestine (1), I found beside a well near the village of Beit Nabala, 6 km. of Lydda (fig 1), a heap of interesting fossiliferous rocks which had been dug out of the well. The rocks were bituminous, phosphatic limestone, containing bones and teeth of sharks and reptiles, and in addition impressions of various molluscs. Among them there was a fragmental ammonoid impression, which I was unable to determine owing to the incompleteness of the fossil. The rocks were of unmistakable Upper Senonian age. Similar fragments I found near the village Al Qubab, on Jaffa-Jerusalem road, 10 km. S.S.E. of Lydda.

Recently I received from one of my pupils more complete fragments of identical fossils, embedded in a creamy chalk, rich in small brown grains of phosphate and in fish-teeth, doubtlessly belonging to the phosphatic horizon of the Upper Senonian. The exact origin of the fossils was unknown, as they were found among stones supplied for

road construction, but they were most probably brought from the nearby quarries of Innabe, a village 7 km. S.E. of Lydda. Owing to the better state of preservation these fossils, and with their aid also the other, could be identified as *Nautilus libanoticus* Foord and Crick. It is worth note that no Nautili—except one unidentifiable specimen—have been reported from the Senonian of Palestine (13). The present finding is therefore of some interest, especially since until now the species has been known only from the famous fish-fossil bearing locality of Sahel Alma in Lebanon.

2. DESCRIPTION OF THE FOSSILS.

The present description supplements in some details the data given by Foord and Crick.

The material from (?) Innabe (preserved in the collections of the Geological Department, Hebrew University, Jerusalem, under No. 16137) comprises six fragments of Nautili, one of them almost complete. The fossils are casts made of creamy phosphatic chalk. All the fragments are obliquely or horizontally compressed and distorted, thus giving no exact account as to their form and their measures. Nevertheless, their external ornamentation is well enough preserved to allow the determination of the species. The one almost completely preserved specimen evidently represents a young animal, as it is much smaller than the other remains: its maximal diameter is only about 80 mm., its minimal diameter about 50–60 mm. Judging from other fragments a mature specimen must have been at least twice as big, i. e. about 150–160 mm. in the maximal diameter.

It is difficult to estimate the width of the Nautili, owing to their compression. In the least compressed of the fragments, the height of a camera is nearly as great as the width (approximately 40 mm. to approx. 50 mm.), hence the form of the *Nautilus* should be defined as sub-globose.

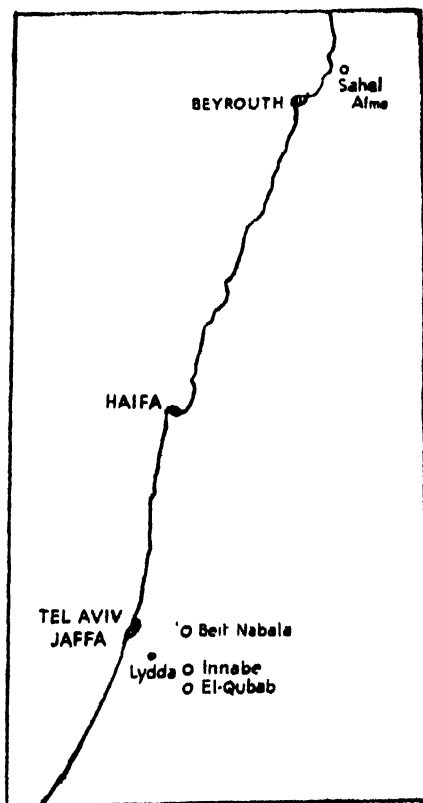
In the young, nearly complete specimen, a suture of a septum is partly visible, and its general outline may be restored: it is slightly sigmoidally curved.

On the above-mentioned fragment of a chamber a slight protuberance on the surface of the septum evidently

represents the place of the siphuncle. It is situated at about one-third of the height of the septum, near the outer (ventral) margin.

The ribs are fairly prominent, narrow and almost sharp in the young stages of the whorls and broad and flat in the older stages (fig. 2). The interspaces between the

Fig. 1.



Situation of the deposits containing *Nautilus libanoticus*.

ribs are rounded and broad. In the young parts of the whorls there are 5-6 ribs per cm., while in the older there are only 2.5-3 ribs per cm. The ribs often bi-

furcate in the umbilical region (fig. 3), but in the younger volutions the bifurcation is less frequent.

The umbilicus is very small.

The fragments from two other localities illustrate similar morphological details.

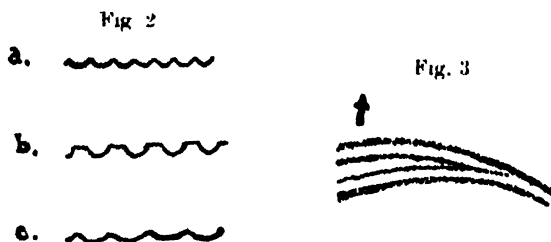


Fig. 2 —Cross sections of the ribs of *N. libanoticus*
a. Neptonic stage, b. Neanic stage, c. Gerontic stage.

Fig. 3 - Bifurcation of the ribs in *N. libanoticus*,
the arrow showing the forward direction

3. PALÆONTOLOGICAL RELATIONS.

This diagnosis corresponds to *Nautilus libanoticus* Foord and Crick ("Shell much inflated, rapidly increasing, broadest in the umbilical region. Umbilicus probably closed. Test ornamented with prominent acute ribs, separated by interspaces rather exceeding their own width. Some of the ribs bifurcate in the region of the umbilicus."). The species was first quoted by O. Fraas as *Ammonites traskii* Gabb (1878, p. 97, pl. iv. fig. 4). Later Noettling corrected the determination of Fraas, classifying the fossil as *Nautilus* sp. (8). Foord and Crick published the first detailed account of this species in 1890, and a year later it was re-described and re-figured by Foord in his 'Catalogue.' The British Museum possesses several specimens, all of which are, however, in a poor state of preservation.

Foord places *N. libanoticus* in the vicinity of *N. elegans* Sow., although he remarks that "the character of the ornaments in the latter differ from that of the former, the ribs being at once broader and closer together in Sowerby's species than they are in the present one". It seems to us that *N. libanoticus* is nearer to *N. atlas* Whiteaves (= *N. elegans* d'Orb. non Sow.). This would be indicated by

the position of the siphuncle as it appears to be revealed by one of our specimens. In our specimen the proportion of the distances between the ventral and dorsal borders to the siphuncle is 9 : 16, while in d'Orbigny's *N. elegans* = *N. atlas* Whiteaves the same proportion is 6 : 11, e. g. practically the same.

4. REMARKS ON STRATIGRAPHICAL AND PALÆOGRAPHICAL SIGNIFICANCE.

The specimen from Beit Nabala was accompanied by the following fauna (Avnimelech, p. 59) :—

Teeth of fishes, especially of *Selachii*.

Teeth and bones of Reptiles.

Arca parallela Conrad.

Inoceramus cf. *regularis* d'Orb.

Pycnodonta vesicularis Lmk.

Pecten (*Synclonema*) *delumbis* Conrad.

Dentalium alternans Müller (= *cretaceum* Conrad).

Baculites vertebralis Lmk.

Ammonites sp. (tuberculate type).

Hamites sp.

The species from Innabe were accompanied by :—

Baculites, probably *vertebralis* Lmk.

A Mosasaurian tooth, most probably *Leiodon unceps* Owen.

Numerous *Selachia* teeth, among them *Lamna appendiculata* Agassiz.

Globigerina cretacea d'Orb.

Gumbelina striata Ehrenberg.

Dentalina cf. *annulata* Reuss.

Globorotalia sp.

Eponides sp.

The fauna and rocks of both these localities evidently belong to the same or nearly the same horizon of the Campanian.

The discovery of *N. libanoticus*, together with its accompanying fauna, in Palestine, indicates that the fish-bearing locality of Sahel Alma in Lebabon is not peculiar in its facies but constitutes a part of a wider neritic zone of Upper Senonian in the Syrian-Palestinian border region.

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LIII.—*The Crustacea, Amphipoda, of County Down.*

By RANALD MACDONALD.

SINCE the appearance of 'A History of the British Sessile-eyed Crustacea' (Bate and Westwood, 1863), the Amphipoda of County Down have but little attracted the attention of local naturalists. During the interval of time which has elapsed since the publication of the above work, many papers have appeared dealing with the Marine Fauna of Ireland, including the Amphipoda, but very few of these refer to the area under consideration and references to the Amphipoda of Down are rare. The desire to remedy in some measure this deficiency has prompted the compilation of the following list of species, which is based in the main on the work of Thompson, Kinahan, and Bate and Westwood.

The Amphipod fauna of County Down comprises eighteen families, which in turn are made up of thirty-seven genera, representing fifty species.

At the end of the paper there will be found an additional list of doubtful species, together with notes on those peculiar to the district.

The species marked with an asterisk are recent additions to the fauna of Down.

SYSTEMATIC LIST.

Suborder GAMMARIDEA.

Family **Lysianassidæ**.

Opisa eschrichti (Kroyer).

Strangford Lough, dredged (Thompson).

Lysianassa ceratina (A. Walker).

Strangford Lough (Norman). Off Killyleagh (Strangford L.), dredged. Angus Rock, entrance to Strangford Lough.

Lysianassa plumosa Boeck.

Bangor (Kinahan).

Orchomene humilis (Costa).

Off Killyleagh, Strangford Lough, dredged.

Family **Ampeliscaidæ**.

Ampelisca brevicornis (A. Costa).

Belfast Bay and Newcastle (Kinahan).

Ampelisca diadema (A. Costa).

Belfast Bay (Spence Bate).

Ampelisca typica (Bate).

Belfast Bay (Kinahan).

Family **Haustoriidæ**.

Bathyporeia pilosa Lindstrom.

Kilclief, pool on shore.

Urothoe pulchella (A. Costa).

Strangford Lough.

Family **Stenothoidæ**.

Stenotha monoculoides (Montagu).

Belfast Bay and Bangor (Kinahan). Groomsport, Kilclief, Donaghadee, Ardglass Harbour, Ballymacormack Point and Angus Rock, Strangford Lough.

Family **Acanthonozomidæ**.

Panoploea minuta (O. Sars).

Dredged off Killyleagh, Strangford Lough.

Iphimedia obesa Rathke.

Belfast Bay (Kinahan). Off Killyleagh, Strangford L. dredged. I have indicated the position thus.

Family **Ædicerosidæ**.

Pontocrates arenarius (Bate).

Ardglass Harbour, in sand, dredged.

Westwoodilla cæcula (Bate).

Belfast Bay (Kinahan).

Family **Callopidæ**.

Apherus jurinei (H. Milne-Edwards).

Carnalea, Groomsport, Donaghadee, Ballywalter, Chapel Bay (Great Copeland Island), Portlehan, Angus Rock, Ardglass and Rossglass.

Apherusa cirrus (Bate).

Bangor (Bate).

Apherusa bispinosa (Bate).

Bangor (Kinahan). Groomsport, Donaghadee, Ballymacormack Point, Ardglass Harbour and Killough.

Family **Gammaridæ**.

Melita palmata (Montagu).

Cultra (Kinahan).

Melita obtusata Montagu.

Off Strangford Bar, dredged.

Mæra othonis (M. Edwards).

Bangor (Kinahan).

Marinogammarus marinus (Leach).

Groomsport, Donaghadee and Ardglass.

Marinogammarus obtusatus (Dahl).

Groomsport, Angus Rock, Kilclief, Ardglass Harbour, Smelt Mill Bay.

Marinogammarus finmarchicus (Dahl).

Angus Rock and the following two islands of the Copeland group, Great Copeland and Lighthouse Island.

Gammarus locusta (L.).

Belfast Lough (Kinahan). Coalpit Bay, Mew Island and Ardglass Harbour.

Gammarus duebeni Lilljeborg.

Kinnegar, Donaghadee and Killough.

Family **Dexaminidae**.

Dexamine spinosa (Montagu).

Ballywalter, Newcastle and Strangford Lough (Thompson). Belfast Lough (Kinahan). Groomsport, Great Copeland Island, Ardglass Harbour and Killough.

**Dexamine thea* Boeck.

Ballymacormack Point, Kilclief, Great Copeland Island, and Ardglass Harbour.

Family **Talitridae**.

Talitrus saltator (Montagu).

Belfast Bay, Groomsport, Crawfordsburn and Newcastle (Kinahan). Cultra (Bate and Westwood). Millisle.

Orchestia mediterranea A. Costa.

Belfast Bay (Kinahan). Rough Island (Bate and Westwood). Groomsport and Killough.

Orchestia gammarella (Pallas).

Groomsport, Crawfordsburn, Belfast and Strangford Loughs (Kinahan). Orlock, Kilclief, Carnalea, Rossglass, Cloughey, Islandtaggart, Mew Island and Lighthouse Island.

**Hyale nilsoni* (Rathke).

Groomsport, Donaghadee, Ballywalter, Angus Rock, Kilclief, Portlehan, Ardglass Harbour and Great Copeland Island.

Family **Aoridae**.

**Microdeutopus anomalus* (Rathke).

Off Killyleagh, dredged. Ardglass Harbour

Microdeutopus damnoniensis (Bate).

Off Killyleagh, dredged.

**Lembos websteri* (Bate)

Angus Rock, Groomsport.

Family **Photidae**

**Eurystheus maculatus* (Johnston).

Groomsport.

Podocerops sophiæ Boeck

Belfast Lough (Thompson, *vide* Bate and Westwood).

Family **Amphithoidae**.

Amphithoe rubricata (Montagu).

Springvale and Strangford (Thompson). Newcastle and Bangor (Kinahan). Groomsport, Ballywalter, Angus Rock, Kilclief and Ardglass Harbour

**Pleonexes gammaroides* Bate

Groomsport, Donaghadee, Ballywalter, Ardglass Harbour and Great Copeland Island.

**Sunamphithoe pelagica* (H. Milne-Edwards).

Groomsport, Ardglass Harbour and Great Copeland Island.

Family **Jassidae**.

Jassa falcata (Montagu).

Donaghadee and Strangford Lough (Thompson). Groomsport.

Family **Corophiidae**.

Erichthonius brasiliensis (Dana).

Belfast Lough (Kinahan).

Talorchestia deshayesei (Audouin).

Crawfordsburn (Kinahan).

Corophium volutator (Pallas).

Belfast and Strangford Loughs (Thompson).

Suborder HYPREIIDEA.

Family **Hyperidae**.

Hyperia galba (Montagu).

Belfast Lough (Kinahan).

Suborder CAPRELLIDEA.

Pseudoprotella phasma (Montagu).

Portaferry, dredged on sand (Thompson).

Caprella acanthifera Leach.

Coralline pools, Springvale (Thompson). Groomsport and Ardglass Harbour.

Caprella linearis (L).

Strangford Lough, dredged (Thompson).

Caprella tuberculata (Bate and Westwood).

Near Portaferry, dredged (Thompson).

SPECIES PECULIAR TO COUNTY DOWN.

The following species, which occur in the preceding list, have not apparently as yet been recorded from any other part of Ireland :—

Opisa eschrichti (Kroyer).

Distribution :—W. Greenland, Faroes, N. Norway and Korea Sea.

Bathyporeia pilosa Lindstrom.

Distribution :—Gt. Britain, Denmark, Baltic and Oslo-Fjord.

Podoceropsis sophiæ Boeck.

Distribution :—W. and S. Norway, Cattegat, British Isles, France, Tenerife, Algiers and Bermuda.

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DOUBTFUL SPECIES.

Orchomene humilis (A. Costa).

It is probable that this is the species recorded by Thompson from Bangor as *Anonyx elegans* and from Belfast Lough by Kinahan as *Anonyx minutus*.

Gammarus marinus Leach.

This name was formerly applied to many distinct species of the genus *Marinogammarus* (Schell.), hence records other than my own are omitted.

Gammarus campylops Leach.

Recorded by Thompson from the river Lagan. Regarding the species *G. campylops*, Sexton and Spooner state that "the species remains indeterminate, and the name *campylops* or *campylops* Leach has to be relegated as a doubtful synonym of one of the species of *Marinogammarus*."

Parupleustes bicuspidis (Kroyer).

Belfast Lough (Scharff).

Chelura terebrans Phillipi.

Belfast Bay (Thompson, *vide* Bate and Westwood). Probably an error, as Thompson states that he could not find it in the Lough.

Finally my thanks are due to Professor Flynn and to Mr. G. Williams, M.Sc., for their kindness in allowing me to join the Queen's University Easter vacation course in Marine Zoology at Ardglass on a number of occasions, and to Mr. J. G. MacWilliams of Groomsport and my wife for assistance in the collection of specimens at various times.

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LIV.—*The Fishes of the Family Clinidae in South Africa.*

By J. L. B. SMITH.

Family CLINIDÆ.

Vertebrae numerous. Body moderately to quite elongate, fairly to very compressed. All fin rays simple. A dorsal fin along most of the back, originating on the head, composed of many spines and a few soft rays, often with a distinct crest on the nape. Anal of two spines and many soft rays. Scales cycloid, small to minute, rarely imbricate, occasionally wanting. Lateral line either a double series of pores for entire course, or double anteriorly with single tubules posteriorly, or of single tubules for entire length, sometimes obsolescent posteriorly. Gill membranes united, free from isthmus. Gill-rakers few, feeble. Mouth fairly large, protractile. Villiform teeth in one or more series in each jaw, the outer usually enlarged. Vomer usually dentate. A supra-orbital tentacle often present. Pelvics of a hidden spine and 2-3 thickened rays, employed as limbs for crawling.

As here defined, the family is restricted to those forms which possess a characteristic upturned hook-like process on the inner margin of the shoulder girdle beneath the operculum.

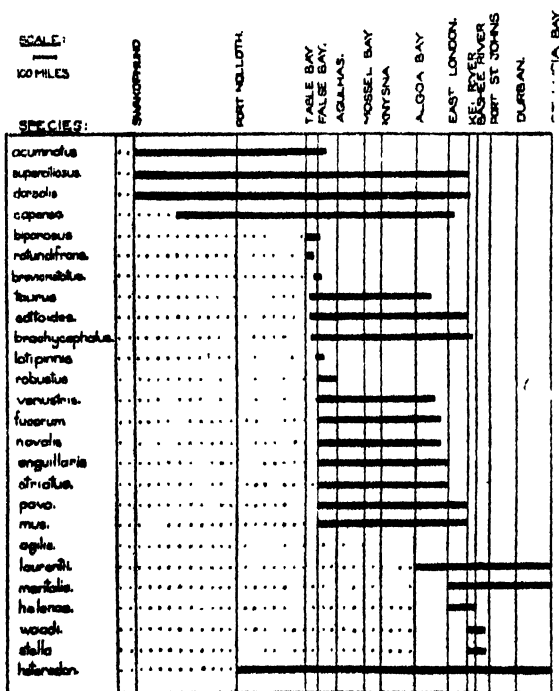
A family of polymorphous forms hitherto somewhat uncritically lumped together mainly in the genus *Clinus* Cuvier. Several clear-cut genera proposed by earlier workers have been ignored.

Recent workers have accepted 24 South African species, allocated mainly to *Clinus* Cuv., altogether to four most arbitrarily defined genera. One species has now been found invalid, while three new forms have recently been discovered. The 26 species, all endemic, fall into 15 well-defined genera, of which eight are probably endemic.

The Australian and South American forms stand in need of revision on comparable lines.

These are rather small viviparous carnivorous shore fishes, mainly of the southern hemisphere. The South African species are most abundant along the southern Cape coast (see fig. 1), and live mainly in tide-pools, in

Fig. 1.



Distribution of Clinid species in South Africa.

weed and under stones at and below low-tide mark, a few extending regularly into deeper water. The flesh of the larger species is of epicurean delicacy.

Key to the South African genera.

The main cleavage lies between those with a tentacle above the orbit and those which have none. In South Africa there are no species with nuchal filaments, and none with simple supra-orbital tentacles.

Subfamily CLININÆ.

A (fringed) tentacle above the orbit. Vomerine teeth always present. Teeth in bands in the jaws.

- A. Snout and chin with barbels 1. *Cirrhibarbis*.
- B. No barbels on chin or snout.
 - 1. Only one soft dorsal ray.
 - a. Lateral line with double pores for entire length 2. *Climacoporus*.
 - b. Lateral line with double pores anteriorly only 3. *Muraenoclinus*.
 - 2. More than one soft dorsal ray.
 - a. Body elongate, depth 6-8. Cheeks scaly 4. *Blennophis*.
 - b. Depth 3-5. Cheeks not scaly.
 - i. A strong bony ridge above eye. Inter-orbital deeply concave. Snout very blunt 5. *Blenniominus*.
 - ii. No, or feeble, ridge above eye. Inter-orbital flat or convex. Snout not very blunt.
 - x. First three dorsal spines form a distinct crest on head with a marked notch between the third and fourth spines.
 - † Membrane from third spine rarely reaches base of fourth 6. *Petraites*.
 - †† Membrane from third spine clearly attached well up fourth 7. *Clinus*.
 - y. No crest or if first three dorsal spines slightly elevated no notch between third and fourth spines. 8. *Ophthalmolophus*.

Subfamily MYXODINÆ.

No tentacle above the eye. Vomerine teeth usually present. One or more series of teeth in the jaws.

- A. Hindmost spine of dorsal very short, causing a deep notch before the soft rays. 9. *Blennioclinus*
- B. Hindmost dorsal spine not short, no notch before soft rays.
 - 1. Vomerine teeth absent.
 - a. Dorsal elevated originates close behind eye. No notch third to fourth dorsal spines 10. *Myzodes*.
 - b. Dorsal fairly low, well behind eye, deep notch between third and fourth spines 11. *Fucominus*.
 - 2. Vomerine teeth present.
 - a. First dorsal spine distinctly longer than the fourth, anterior three spines forming a crest.
 - i. Dorsal crest quite separate. Membrane from third spine barely reaches base of fourth 12. *Labroclinus*.
 - ii. Dorsal crest not separate. Membrane from third spine well connected to fourth 13. *Pavoclinus*.

- b. First dorsal spine not or barely longer than the fourth. No marked crest.
- i. Lateral line of single tubules, virtually obsolete posteriorly 14. *Gynutoclinus*
 - ii. Lateral line of double pores alternately above and below for whole length 15. *Clinoporus*.

1. Genus *Cirrhibarbus* Cuvier.

Cuvier, Règne Animal, 1829, ii, p. 238.

Type *Cirrhibarbis capensis* C. & V. Monotypic.
Endemic.

A tentacle above eye. Snout and chin with barbels. Lateral line anteriorly of pores in two opposite series, above and below. No anterior crest in dorsal.

Cirrhibarbus capensis C. & V.

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 131. (*Clinus c.*)

Depth 5½. D XL–XLIV, 5–8, front spines shortest. A II 27–34. V I 3. Three barbels on snout, eight on chin. Attains 15 ins. Southwest Africa to East London, not uncommon.

2. Genus *Climacoporus* Barnard.

Barnard, Ann. S. Afr. Mus. 1935, xxx, p. 646.

Type *Climacoporus navalis* Barnard. Monotypic.
Endemic.

A tentacle above eye. A single soft dorsal ray. Lateral line of two series of opposing pores for entire length. No anterior crest in dorsal.

Climacoporus navalis Barnard.

Barnard, Ann. S. Afr. Mus. 1935, xxx, p. 646, fig.; Smith, Ann. Natal Mus. 1936, p. 195.

Depth 5½. D XXXIII–XXXVII, 1. A II 22–24. V I 3. About 80 double pores in lateral line. Attains 3 ins. False Bay to East London, not abundant.

3. Genus *Muraenoclinus*, nov.

Type *Clinus dorsalis* Bleeker. Monotypic.

A tentacle above eye. A single soft dorsal ray. Lateral line of mainly double pores anteriorly, single tubules posteriorly. No anterior crest in dorsal.

Muraenoclinus dorsalis Blkr.

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 132. (*Clinus d.*)

Depth 5–6. D XLIII–XLVI, 1. A II 22–24. V I 2. Attains 4 ins. Swakopmund to the Kei River, Abundant.

4. Genus *Blennophis* Swainson.

Swainson, Nat. Hist. Fishes, 1839, ii, p. 276.

Type *Clinus anguillaris* C. & V.

A tentacle above eye. Cheeks scaly. Body elongate. Two to four soft dorsal rays. No anterior dorsal crest. Lateral line of double pores anteriorly, single tubules posteriorly.

- A. Third pelvic ray stout *anguillaris*.
B. Third pelvic ray minute *striatus*.

Blennophis anguillaris (C. & V.).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 133. (*Clinus a.*)

Depth $6\frac{1}{2}$ – $7\frac{1}{2}$. D XLVIII–L, 3–4, uniformly low. A II 33–36. V I 3. Attains 12 ins. False Bay to East London, not uncommon.

Blennophis striatus (Gilchrist & Thompson).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 134. (*Clinus s.*)

Depth $6\frac{1}{2}$ –7. D XLI–XLIV, 2–3. A II 28–31. V I 3. Attains 7 ins. False Bay to East London, rare.

5. Genus *Blenniominus*, nov.

Type *Clinus taurus* G. & T. Endemic.

A tentacle above eye. Cheeks naked. Supra-orbital ridge prominent, inter-orbital deeply concave. Snout blunt, appearance markedly blennioid. Lateral line of double pores anteriorly, single tubules posteriorly. No anterior crest in dorsal.

- A. A notch in membrane between third and fourth dorsal spines *taurus*.
B. No notch, third and fourth dorsal spines *cottoides*.

Blenniominus taurus (G. & T.).

Gilchrist and Thompson Ann. S. Afr. Mus. 1908, vi, p. 126. (*Clinus t.*)

Depth $3\frac{1}{2}$. D XXXI–XXXV, 5–6. A II 21–24. V I 2–3. Attains 8 ins. False Bay to Port Alfred, not abundant.

Blenniominus cottoides (C. & V.).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 125. (*Clinus c.*)

Depth 4–5. D XXXII–XXXVI, 4–6. A II 21–24. V I 2–3. Attains $4\frac{1}{2}$ ins. False Bay to the Kei River, very abundant.

6. Genus *Petrates* Ogilby.

Ogilby, Proc. Linn. Soc. N.S. Wales, 1885, x, p. 226.

Type *Clinus heptacolus* Ogilby.

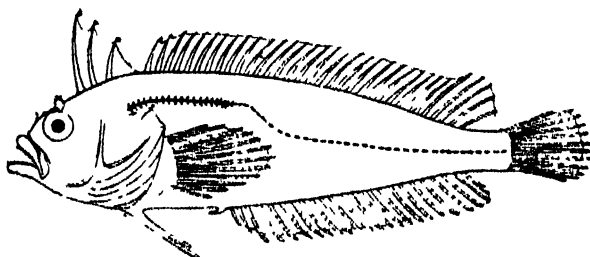
A tentacle over eye. A detached anterior crest in dorsal fin. Cheeks naked. Lateral line of double pores in front, single tubules posteriorly.

- A. Crest close behind eye *woodi*.
 B. Crest not close behind eye *brevicristatus*.

Petraites woodi, sp. n. (Fig. 2.)

Body robust. Depth equals length of head, 3.6–3.8 in body length. Eye subequal to snout, 4.2–4.6 in head. Snout fairly blunt. Lips thick. Teeth in bands with enlarged outer series in each jaw. A chevron-shaped band on vomer. Maxilla extends below anterior third of eye. A prominent fringed tentacle above the eye. Interorbital convex. D III+XXVIII, 5–6, inserted just

Fig. 2.



Petraites woodi, sp. n. $\times \frac{1}{2}$.

behind eye, with detached nuchal crest of three spines, each apex bearing a conspicuous cluster of cirri. A II 22. V I 2. Caudal gently rounded. Scales fairly large, imbricated. Colour vivid in marbled olive, brown and red, with obscure irregular cross-bars. One or two red oblique bars across cheek. Up to 150 mm. length. A recent discovery, below low tide mark in weeds, Bashee River to Umtata River. Not uncommon.

Petraites brevicristatus (Gilchrist & Thompson).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 118. (*Clinus* b.)

Depth 4. D III+XXXI, 5. Dorsal crest low in type, ♀ only known specimen, from False Bay, length $3\frac{1}{2}$ ins.

7. Genus *Clinus* Cuvier.

Cuvier, Règne Animal, 1817, p. 251.

Type *Blennius superciliosus* Linn.

A tentacle over the eye. A marked anterior crest in the dorsal fin not detached, membrane between third and fourth spines incised.

- A. Two pelvic rays *superciliosus*.
 B. Three pelvic rays *robustus*.

Clinus superciliosus (Linn.).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 115; and p. 116 (*Clinus ornatus* G. & T.); Barnard, Ann. S. Afr. Mus. 1927, xxi, p. 855; and p. 856. (*C. ornatus* G. & T.)

Depth $3\frac{1}{2}$ - $4\frac{1}{2}$. D XXXIII-XLII, 5-9, first three spines form an elevated crest in ♂, lower in ♀, not detached, membrane between third and fourth spines deeply notched. A II 24-30, V I 2. Attains 12 ins. The most abundant species in South Africa, from Swakopmund round to the Kei River. Most variable in form and coloration. *C. ornatus* G. & T. is one rather rare variation of the adult ♂ showing forward development of the nuchal region.

Clinus robustus G. & T.

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 128; Barnard, *ibid.* p. 860, pl. 35, fig. 2.

Depth 4- $4\frac{1}{2}$. D XXXII-XXXIV, 9-14, rather low crest, a deep notch between third and fourth spines. A II 27-28. V I 3. Lips vertically striate. Attains 20 ins. Cape Peninsula only, not uncommon.

8. Genus *Ophthalmolophus* Gill.

Gill, 1860, Proc. Ac. Nat. Sci. Phil. p. 104.

Type *Clinus latipinnis* C. & V.

A tentacle over the eye. No crest, dorsal low in front.

- A. 2-4 soft dorsal rays.
 1. 34-35 dorsal spines *agilis*.
 2. 39-41 dorsal spines *venustatrix*.
 B. 5-7 soft dorsal rays.
 1. 31-33 dorsal spines *acuminatus*.
 2. 34-37 dorsal spines *helenæ*.
 C. 8-10 soft dorsal rays *latipinnis*.

Ophthalmolophus agilis (Smith).

Smith, J. L. B., Rec. Alb. Mus. 1931, p. 154, fig.

Depth 4-5. D XXXIV-XXXV, 3-4. No crest, a shallow notch, third to fourth spines. A II 21-24. V I 2-3. Attains 3 ins. Known only from shelter of *Zostera* in Knysna estuary. Rare.

Ophthalmolophus venustis (G. & T.).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 130. (*Clínus v.*)

Depth 4. D XXXIX-XLI, 2-3. No crest, second spine sometimes elongated free from membrane. A II, 24-27. V I 2. Attains 6 ins. False Bay to Port Alfred. Not plentiful.

Ophthalmolophus acuminatus (C. & V.).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 124. (*Clínus a.*)

Depth 4-5. D XXXI XXXIII, 5-7, no crest. A II 21-23. V I 2-3. Attains 5 ins. Confined to the colder waters, Swakopmund to Cape Peninsula, abundant.

Ophthalmolophus helenæ, sp. n. (Fig. 3.)

Body fairly compressed. Depth 4·5-4·8, length of head 3·6-3·9 in length of body. Eye 4·5-5·0 in head, somewhat greater than snout. Maxilla reaches below centre of eye. Teeth in bands with an outer enlarged series in

Fig. 3.



Ophthalmolophus helenæ, sp. n. ♂.

each jaw. A curved band on vomer. Lateral line of 29-32 double pores anteriorly becoming single tubules posteriorly. A multifid tentacle above the orbit. D XXXIV-XXXVII, 6-7, first four spines shortest. A II 22-24. P 12. V I 2. Caudal gently rounded. Light brown with seven darker broken cross-bands. Darker spots and speckles on head and body. Attains 4½ ins. Intertidal pools, East London to Bashee River. Not common.

Ophthalmolophus latipinnis (C. & V.).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 127. (*Clínus l.*)

Depth 4½. D XXXIV, 9, no crest. A II 26. V I 3. Attains 4½ ins. Cape Peninsula, rare.

9. Genus *Blennioclinus* Gill.

Gill, Proc. Acad. Nat. Sci. Phil. 1860, p. 103.

Type *Clinus brachycephalus* C. & V. Endemic.

No tentacle above eye. Posterior spine of dorsal very short, causing a deep notch before the soft rays. Anterior part of lateral line a double series of pores.

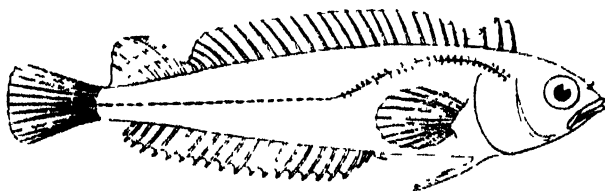
A. 6-7 soft dorsal rays *stella*.

B. 9-10 soft dorsal rays *brachycephalus*.

Blennioclinus stella, sp. n. (Fig. 4.)

Body slender, fairly compressed. Depth slightly less than head, 4.3-4.6 in length of body. Eye greater than snout, 3.6 in head. Maxilla extends below anterior third of eye. A single row of smaller teeth anteriorly behind the outer series in each jaw. A curved band of two series on vomer. No tentacle above eye. D XXVII, 6-7, no crest, notched between third and fourth spines, smaller

Fig. 4.



Blennioclinus stella, sp. n. . 2.

notches in next few spines. Anterior spines in ♂ bear clusters of apical cirri. A II 19-20. V I 3, inner ray minute. Caudal subtruncate. Scales minute not imbricate. Variably brown red orange mottled. Three narrow bars across head, one through eye to cheek. Eight to ten cross-bars on body, spreading to dorsal fin. Sometimes iridescent silvery patches along flanks. The smallest South African Clinid, mature at 1½ ins. Kei River to Umtata River, rare.

Blennioclinus brachycephalus (C. & V.).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 135. (*Clinus b.*)

Depth 4½-5. D XXVI-XXX, 9-11, a deep notch between third and fourth spines, front three spines forming a slight crest. A II 23-25. V I 3. Attains 6 ins. Cape Peninsula to the Kei River, fairly plentiful,

10. Genus *Myxodes* Cuvier.

Cuvier, Règne Animal, 1829, ii, p. 238.

Type *Myxodes viridis* C. & V.

No tentacle over eye. Teeth in jaws in one series and vomer edentate. Body very compressed. Caudal peduncle long. Lateral line of single tubules.

Myxodes fucorum (G. & T.).

Barnard, Ann. S. Afr. Mus. 1927, xxi, p. 853. (*Clinus* f.)

Depth $3\frac{1}{2}$ -4. D XXVIII-XXX, 5-6, inserted close behind eye. Margin of dorsal undulate with anterior elevation, not detached. A II 19-21. V I 3. Somewhat simocephalous. Attains 12 ins. False Bay to East London. Rare.

11. Genus *Fucomimus*, nov.

Type *Clinus mus* G. & T. Monotypic.

No tentacle over eye. Teeth in jaws in two series and vomer dentate. Body very compressed. Caudal peduncle long. Lateral line of single tubules.

Fucomimus mus (G. & T.).

Barnard, Ann. S. Afr. Mus. 1927, xxi, p. 854. (*Clinus* m.)

Depth 3-3 $\frac{1}{2}$. D III+XXII-XXIV, 3-4, first three spines almost fully detached. Margin of dorsal undulate. A II 15-17. V I 3. Attains 4 ins. False Bay to the Kei River, abundant in weeds.

12. Genus *Labroclinus*, nov.

Type *Clinus mentalis* G. & T. Endemic.

No tentacle over eye. Vomer dentate. Body fairly robust. A separate elevated dorsal crest. Lateral line of single tubules. Scales imbricate at least anteriorly.

A. Lower lip with expanded flap *mentalis*.

B. Lower lip normal *laurentii*.

Labroclinus mentalis (G. & T.).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 139. (*Clinus* m.)

Barnard, *ibid.* 1927, xxi, p. 866. (*Petraites* m.)

Depth 4 $\frac{1}{2}$. D III+XXXII-XXXIII, 7-8, margin of fin slightly undulate. A II 27-30. V I 3. Attains 12 ins. East London to Zululand, rather rare.

Labroclinus laurentii (G. & T.).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 120. (*Clinus* l.)

Barnard, *ibid.* 1927, xxi, p. 866 (*Petraites* l.); Smith, Rec. Alb. Mus. 1936, p. 218, fig.

Depth 4. D III+XXVI-XXIX, 4-5. A II 27-30. V I 3. Attains 8 ins. Port Alfred to Zululand, not uncommon.

13. Genus *Pavoclinus*, nov.

Type *Clinus pavo* G. & T. Endemic.

No tentacle over eye. Body fairly compressed. Nuchal dorsal crest distinct but not detached, first spine shorter than second. Vomer dentate. Lateral line of single tubules.

- A. Three soft dorsal rays *pavo*.
B. Four to six soft dorsal rays *heterodon*.

Pavoclinus pavo (G. & T.).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 123 (*Clinus p.*).

Depth 3½. D XXX-XXXV, 3, crest not separate, an oval space between second and last soft ray. A II 20-22. V I 3. Scales not imbricate. Attains 6 ins. False Bay to the Kei River, not plentiful.

Pavoclinus heterodon (C. & V.).

Gilchrist and Thompson, Ann. S. Afr. Mus. 1908, vi, p. 138 (*Clinus h.*), and p. 136. (*Clinus graminis* G. & T.); Barnard, Ann. S. Afr. Mus. 1927, xxi, p. 863 (*Clinus h.*); Smith, Rec. Alb. Mus. 1936, p. 217, fig. (*Clinus h.*)

Depth 3½-4. D XXX-XXXIV, 5-6, crest not separate. A II 21-24. V I 3. Scales distinct and imbricate. Attains 6 ins. Port Nolloth to Zululand, abundant.

14. Genus *Gynutoclinus*, nov.

Type *Clinus rotundifrons* Barnard. Monotypic. Endemic.

No tentacle over eye. No dorsal crest. Snout blunt. Lateral line of single tubules, obsolete posteriorly. Scales minute.

Gynutoclinus rotundifrons (Barnard).

Barnard, Ann. S. Afr. Mus. 1937, xxxii, p. 63, fig.

Depth 3½. D XXX, 8. Second and third spines longer than first and fourth, no crest. A II 22. V I 3. Only the type ♀, 3½ ins. in length, known. Cape Peninsula.

15. Genus *Clinoporus* Barnard.

Barnard, Ann. S. Afr. Mus. 1927, xxi, p. 864.

Type *Clinus biporosus* G. & T. Monotypic. Endemic.

No tentacle over eye. Scales absent. No dorsal crest. Lateral line of alternating branches above and below opening each by a pore, ending on peduncle in a single pore.

Clinoporus biporosus (G. & T.).

Barnard, Ann. S. Afr. Mus. 1927, xxi, p. 864.

Depth 6. D XXXVIII-XL, 3, front spines widely spaced, shortest. A II 27-28. V I 3. No scales. Attains 5 ins. Cape Peninsula, not plentiful.

The author wishes to acknowledge financial assistance from the National Research Board of South Africa.

Albany Museum,
Grahamstown,
December, 1945.

LV.—*Observations of some British Chrysomonads.*—II.

Chrysostephanosphaera globulifera Scherffel. By FRANK W. JANE (Dept. of Botany, University College, London).

SCHERFFEL (1911) gave the name *Chrysostephanosphaera globulifera* to a chrysophycean alga which he found in moorland pools in Bohemia and Hungary. The alga formed colonies of up to 16 cells, arranged in a ring within a spherical mass of mucilage. The mucilage was characterised by the presence of numerous, small, spherical bodies, which the author termed excretion spheres. As well as the colonies, single cells were seen, sometimes free from mucilage; they were shaped rather like a biconvex lens, and sometimes long, fine pseudopodia arose from the margin: excretion spheres were associated with such rhizopodial cells. In the colonies of from two to four cells, the protoplasts were sometimes rhizopodial, but the cells of larger colonies did not assume this form.

Stein (1878) had figured an alga so similar in appearance that Scherffel was satisfied that the two were identical. Stein regarded his alga as a possible resting stage of *Chromulina flavicans*; he found no cells with rhizopodia.

In March 1942 the present author collected an organism which proved to be identical, in essentials, with *Chrysostephanosphaera globulifera*. It was found on Llandegfan Common, Anglesey, restricted, apparently, to one of the small temporary pools in that locality; it was not uncommon, but since that time only one or two colonies have been met with in the pool. The alga was subsequently collected from three localities in Caernarvonshire, isolated specimens from a pool near Aber Falls

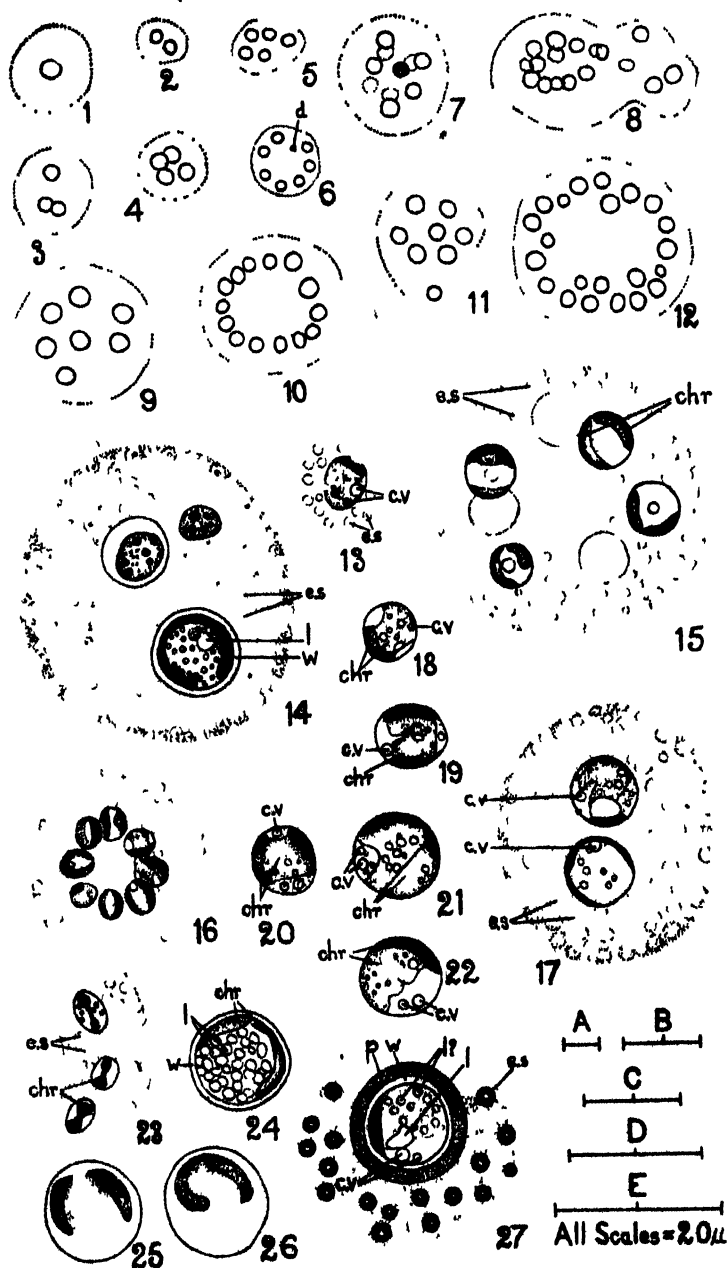
and from another near Llyn Ogwen, both in the early summer, while during May 1943 a number of specimens were found in a pool near Tremadoc. The organisms proved to be very intolerant to changes of environment, and could not be kept in culture for more than a few days.

The colonies consist of a mass of mucilage, in which are embedded a number of protoplasts, as well as many small, refringent spheres. While the shape of the mucilage is normally spherical or ellipsoidal, more irregularly shaped masses are sometimes found (figs. 8, 11). Single cells, embedded in mucilage, are occasionally seen (fig. 1) and a colony may consist of no more than two cells (fig. 17), although it may contain as many as 30 (figs. 2-12). Colonies which are composed of more than 15 or 16 cells may be regarded as fairly large ones. The size of the colony varies within wide limits, nor does it always increase proportionately to the number of cells of which it is composed. Thus the two-celled colony shown in fig. 2 is considerably smaller than the single cell shown in fig. 1, while the seven-celled colony depicted by fig. 9 is much larger than the eight-celled one shown in fig. 6, and also exceeds the dimensions of the ten-celled colony drawn in fig. 7. One of the largest colonies encountered (fig. 12), measured $107\mu \times 100\mu$, one of the smallest (fig. 2) $33\mu \times 27\mu$. the two-celled colony figured by Stein (1878) has a diameter (computed) of 20μ , the largest one figured is 68μ in diameter.

The cells of a colony commonly lie in one plane, in the form of a ring (figs. 10, 16), but this arrangement is not invariable. There may be two or more tiers of cells (figs. 7, 15), and the arrangement of the cells in a tier may be quite irregular. Reference to the illustrations, and especially to figs. 7, 8, 11, 15, will give some idea of the variation. It should be emphasized that the cell arrangement shown in figs. 10 and 16 is by far the most common, although the author has stressed the more unusual types of colony in the figures, since what may be regarded as more usual ones are well illustrated in Stein's (1878) work.

The mucilage of the colony is characteristic, for it contains large numbers of small refringent spherical bodies, in which the centre is often distinct from the periphery (figs. 14, 27). These spheres are the excretion spheres of Scherffel (1911). When a colony is treated

Figs. 1-27.



(For explanation of figs. 1-27, see opposite.)

with dilute methylene blue, the mucilage takes on a pale violet colour, evidence of its pectic nature, while the excretion spheres take up the stain with avidity, staining a deep blue colour at the periphery; a central region, always small relative to the size of the sphere, stains, at most, very faintly (fig. 27). Similarly, in ruthenium red the periphery of the spheres stains more deeply than the ground mucilage, while the centre, again, is but slightly stained, if at all. This avidity for ruthenium red suggests that the spheres contain pectic material, but the evidence for this is conflicting, since they are stained blue and not violet, by methylene blue. These spheres were also tested with Millon's reagent, osmic acid and sudan black, but the reactions to all these tests were negative. Scherffel (1911) observed what appear to be similar bodies in monads of the genus *Lepochromulina*, where they occurred in numbers around the mouth of the lorica. In *L. calyx* Scherffel the spheres were observed within the protoplast and Scherffel saw them thrust out of the cell in the region of the flagella. If the spheres of *Chrysostephanophora* are of the same nature as those of *Lepochromulina*, they are, in the strict sense, excretion spheres; whether they are a waste katabolic product is another matter, and the large numbers present in the mucilage of the alga, their constant occurrence and their very regular form and differentiated central region are

Chrysostephanophora globulifera Scherffel.

Fig. 1, outline drawing of a single individual, surrounded by copious mucilage: scale A. Figs. 2-12, outline drawings of colonies; in fig. 7 the cells shown by a broken line, those shown by a continuous line and the shaded one are at different levels: scale A. Fig. 13, single cell, surrounded by excretion spheres: scale E. Fig. 14, three-celled colony: the two upper cells are moribund, the lowest is a cyst: scale E. Fig. 15, eight-celled colony, with cells in two tiers of four (one of the cells of the lower tier lies behind one in the upper tier): scale D. Fig. 16, colony showing the normal, wreath-like arrangement of the cells: scale B. Fig. 17, two-celled colony: scale E. Figs. 18-22, selected cells to show details of structure: scale E. Fig. 23, part of a colony after treatment in Schimper's iodine solution: the chromatophores of the protoplasts have been shrunk and one is seen in each cell: scale C. Fig. 24, cyst: scale E. Figs. 25, 26, two cells to show shape of chromatophore: scale E. Fig. 27, cyst and surrounding mucilage from colony stained in dilute methylene blue: scale E.

chr., chromatophore, *c.v.*, contractile vacuole; *d.*, dead-cell; *e.s.*, excretion sphere; *l.*, leucosin; *p.*, deeply stained sheath around cyst; *w.*, wall of cyst.

features which, to the present author, appear to militate against this view, rather than to substantiate it.

The protoplasts exhibit considerable variation in size (figs. 18-22), even, sometimes, in the same colony (fig. 12); the diameter, or greatest length, ranges between 7μ and 13μ . The cells are spherical or more or less ellipsoidal.

The protoplast may be enclosed in a thin cell wall, but on this point I was unable to satisfy myself. In many colonies the cells, after staining in methylene blue, appeared to be surrounded by a thin blue sheath, but it is possible that this sheath is no more than a thin zone of mucilage surrounding the cell, and differentiated somewhat from the general mucilage of the colony. There was no evidence that cellulose was present in this region when tests were made with chlor-zinc-iodine solution.

The protoplast is not easy to decipher, and apart from the chromatophore the cells have the hyaline, empty appearance which is so often seen in chrysophycean cells. The chromatophore is bright yellow. Scherffel (1911) states that there were two chromatophores in the protoplasts of the organism which he studied, and this is suggested also by Stein's figures. It is not, of course, certain that the alga under present consideration and those studied by Stein and Scherffel, are identical, although the author believes that this is so, and is inclined to regard the observations of the two older authors upon the chromatophore as erroneous. In the alga under present consideration the single chromatophore has the shape, approximately, of a curved parietal plate, with one or more of its edges, usually the two lateral ones, upturned (figs. 25, 26), a not infrequent type of chromatophore in the Chrysophyceæ. In the organisms which I studied the chromatophores were not deeply pigmented, and consequently, their limits were difficult to make out; the colour, of course, was deeper where the edges were upturned, since in such positions two layers of chromatophore were seen; as a result, most of the protoplasts appeared to possess two lateral chromatophores (figs. 15, 16). This may appear to be a facile explanation, if not an attempt to excuse superficial observation, but exact observation on these chromato-

phores, and those of some other Chrysophyceæ in which they are faintly pigmented, is difficult: I only satisfied myself on this point by studying the chromatophores of cells which had been contracted by the application of reagents (fig. 23).

The cell contains one or two contractile vacuoles, generally situated in that part of the cell which points to the centre of the colony (figs. 17, 21, 22): apart from these organs and the chromatophore the protoplast shows little else. In no instance was a nucleus detected in living cells. The protoplasm sometimes has a granular appearance (fig. 21), but this type of cell appeared to be more frequent in material which had been under observation for some time, so that it may be that such granules (or vacuoles) are associated with cytolysis or, at least, with pre-mortem changes of the protoplasm. In some cells a single, relatively large, refringent leucosin granule may be observed.

Cysts were occasionally observed in a colony (fig. 14). These cysts had a smooth, thick, refractive wall (figs. 24, 27), in which no aperture was observed. Immediately outside this wall, in material stained with methylene blue, there lay a sheath of material which stained a denser violet colour than the general mucilage (fig. 27). It is possible that this should be regarded as the outer wall and the refractive sheath just described, as the inner wall; equally, it may be no more than recently secreted mucilage, of a denser nature than the general mucilage of the colony. The refractive wall is not coloured by methylene blue. The chromatophores of the cysts resemble those of the vegetative cells: contractile vacuoles may be present (fig. 27), or not (figs. 14, 24). Such cysts generally contain a large number of rather small, transparent, refractive granules which may be leucosin (figs. 14, 24), and often, in addition, a relatively large, somewhat irregularly shaped lump of leucosin (figs. 14, 27). The cysts are generally rather larger than the vegetative cells, with a diameter of 11μ – 12μ .

The question of the rhizopodia which were observed by Scherffel in some of the protoplasts remains to be considered. Scherffel was of the opinion that Stein was unable to see these organs by reason of the quality of his lenses; the present author, however, was unable

to find a trace of rhizopodia in any cell which he examined, and also doubts if Stein overlooked them. It is now well known that rhizopodia may be produced at will in some organisms, e.g., *Heterochloris*, and, although apparently not frequently, in *Synura*, perhaps their formation in such organisms is a response to special environmental conditions—it is certain that their presence does not possess diagnostic value. It may well be that the formation of rhizopodia in *Chrysostephanosphæra* is occasional, and that for this reason neither Stein nor the present author was fortunate enough to see them.

Stein's tentative determination of this organism as a resting stage of *Chromulina flavicans* is undoubtedly erroneous. Scherffel (1911) pointed out that the absence of a stigma and the formation of rhizopodia were evidences against this identification. Klebs (1893), indeed, had already questioned Stein's diagnosis. As the cells are vegetative in most colonies, there is strong evidence that the organism is not normally in a resting condition; in fact, cysts may be formed in some colonies.

It may be questioned whether Scherffel (1911) and Pascher (1913), in regarding the organism as related to *Chrysamœba*, have not stressed too strongly the formation of rhizopodia. The present author is of the opinion that the alga is to be regarded as a palmelloid form, and hence referred to the *Chrysocapsinæ*.

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LVI.—*New Cretaceous Cirripedes and Crab*. By THOMAS H. WITHERS, Geological Department of the British Museum (Natural History).

[Plate II.]

THROUGH the keen collecting of the brothers C. W. and E. V. Wright, we are enabled to describe two Cirripedes (one new), and a new Crab, all from ^{the} "Crackers" (Aptian) of the Isle of Wight. Cirripe ^{the} have not been

recorded hitherto from the "Crackers" bed, and one species is of particular interest, since it considerably extends the downward range of the sub-genus *Virgiscalpellum*, here regarded by me as a separate genus.

This opportunity is taken to describe a new Cirripede from the Cretaceous of Texas, kindly submitted to me by Dr. H. B. Stenzel, of the Bureau of Economic Geology, Texas University.

CIRRIPEDIA

SCALPELLIDÆ.

Arcoscalpellum comptum (Withers). (Pl. II. figs. 1, 2.)

1935. *Sc. (Arcoscalpellum) comptum* Withers, Brit. Mus. Cat. Foss. Cirripedia, ii. p. 202, pl. xxiii. figs. 7, 8.

Distribution.—Lower Aptian, Lower Greensand : Maidstone and Sevenoaks, Kent : "Crackers" : Atherfield, Isle of Wight.

Holotype and Material.—This species was founded on two terga, the holotype (I. 13403) and paratype (I. 13404), from Sevenoaks, Kent, in the Geological Department of the British Museum. We are now able to make known two carinæ, and two terga, from the "Crackers" of Atherfield, Isle of Wight, collected by C. W. and E. V. Wright.

Measurements.—One carina measures : length 6.3 mm. (slightly incomplete at apex), breadth 1.8 mm., and the other, length 7.8 mm., breadth 2.1 mm.

Carina (No. 10610, Pl. II. figs. 1, 2).—Narrow, length about four times the breadth, moderately bowed inwards ; basal margin obtusely angular. Tectum smooth, flatly arched transversely, weakly carinate in the early stages of growth, and the outer margins of the valve are raised to form a slight and narrow ridge. Parietes narrow, less than half the width of the tectum, slightly splayed outwards, for little of them can be seen dorsally. Intraparietes evidently bent inwards at right angles for the upper part of the valve is solid.

Tergum.—Two broken terga (Nos. 10452-3) agree with the holotype and paratype in having longitudinal ridges on the carinal side of the valve only. On the inner surface two or three short longitudinal ridges are developed near the apex, as in the Gault *A. arcuatum*.

Remarks.—Since this species is evidently the ancestor of the Gault species, *A. arcuatum* it is not unexpected

that the carina, now known for the first time, should resemble the young valves of that species. The three main longitudinal ribs are only weakly developed, and there is no trace between them of further ribs, which are such a feature of the carina of *A. arcuatum*.

Virgiscalpellum Withers.

1935. Brit. Mus. Cat. Foss. Cirripedia, ii. p. 283.

This genus, hitherto regarded by me as a sub-genus of *Scalpellum* (genotype *V. beisseli* (Bosquet and Müller)), was founded (1935, p. 283) on seven species ranging in the Upper Cretaceous from Middle Senonian to Maestrichtian. New material of *V. gabbi*, however, received while my Catalogue was going through the press, convinced me that the scuta described by Bosquet as *Scalpellum radiatum*, really belonged to his species, *S. hagenowianum*, a possibility already suggested by me in the text (1935, p. 297).

The new species, *V. wrighti*, considerably extends the downward range of the genus into the Lower Cretaceous (Aptian), so now *Virgiscalpellum* has a similar range (Aptian to Maestrichtian) to the genus *Cretiscalpellum*. *Arcoscalpellum* is also first found in the Aptian, but extends upwards into the Tertiary, and is known by numerous Recent species.

Two of the Maestrichtian species—*Virgiscalpellum darwinianum* (Bosquet) and *V. ryckholti* Withers—have tubercles developed on the occludent side of the inner surface of the scuta and terga, and in the Senonian species, *V. beisseli* (Bosquet), they are weakly developed on the terga only. It has been suggested by me (1935, p. 284) that these tubercles may have had some connection with the need for a firmer attachment of the lining membrane in these shallow-water forms. This seems to be borne out by their weak development in the comparatively deeper water form, *V. beisseli*, and by the fact that in the new species, *V. wrighti*, from the shallower water Aptian, these tubercles are well-developed.

Virgiscalpellum is peculiar among the Scalpellidæ in that the scutum has an upward and downward development from the commencement of growth, for the umbo is usually slightly below a central position, and this trend towards a more basal position is more marked in

V. darwinianum, for it is placed about one-third the length of the valve from the base. All the species in which the carina is known have the umbo of that valve removed to a varying extent from the apex, and one can see in some species—*V. hagenowianum* and *V. ryckholti*, in which it is near the apex—that the umbo must have been originally apical, and the removal of the umbo due to the upward growth of the valve. A transition can also be seen in the carina from a form like *V. gabbi*, in which the parietes are delimited, to the species *V. darwinianum*, in which the delimitation of the parietes is not seen. In *V. darwinianum* the umbo of the carina is normally central, but in some older specimens it is nearer the base, and in this respect it is more advanced than any other species of *Virgiscalpellum*. The almost fixed position of the umbo of the scutum, for it varies very little in position, suggests that *Virgiscalpellum* was developed early from the parent stock. On the other hand, the greater variation in the position of the umbo of the carina—from nearly apical to just below central—shows that this trend was developed later than that in the scutum. The form of the upper, rostral, infra-median, and carinal latera suggests either that *Virgiscalpellum* was derived from *Arcoscalpellum*, or that they had a common ancestor. *Virgiscalpellum* certainly reached a more advanced development than the later *Scalpellum* (s.str.) stock.

The forms included in the genus *Scalpellum* (s.str.) were evidently derived much later from the *Arcoscalpellum* stock. This is suggested by the ontogenetic development, for while the scutum and carina have sub-central umbones in the adult, they are apical in the young stages, and this late development is borne out by its geological range (Tertiary to Recent).

Virgiscalpellum wrighti, sp. n. (Pl. II. figs. 3–6.)

Diagnosis.—A *Virgiscalpellum* with the scutum having the umbo a little below central; a strong ridge curves upwards to the tergo-lateral angle; lateral margin strongly convex, longer than the tergal margin; rostral angle slightly truncated; adductor muscle pit unusually wide and deep. Tergum like that of *V. beisseli*, but with only two longitudinal ridges placed near the occludent margin,

and the scutal margin unequally divided, the two parts together forming an obtuse angle.

Distribution.—Lower Aptian, Lower Greensand, "Crackers": Atherfield, Isle of Wight.

Holotype and Material.—A scutum (holotype, No. 10454) and a tergum (paratype, No. 10693), collected by C. W. and E. V. Wright.

Measurements.—Scutum (incomplete): length 6.0 mm., breadth 3.1 mm. Tergum: length 8.6 mm., breadth 3.4 mm.

Description.—Carina unknown. Scutum (Pl. II. figs. 3, 4) sub-triangular, strongly convex transversely, umbo a little below central; breadth about half the length; two strong ridges extend from the umbo—one curves sharply upwards to the tergo-lateral angle, and the other slightly curves upwards close to the upper oocludent margin. Oocludent margin gently curved sigmoidally, concave above and convex below; tergal margin straight; basal margin strongly convex, nearly twice the length of the tergal margin; rostral angle narrowly and obliquely truncated. Outer surface comparatively smooth, for the fine ridges are extremely obscure. Inner surface with an unusually deep and wide adductor muscle pit; oocludent edge narrow below, but above the adductor muscle pit it widens rapidly and is somewhat concave; upper oocludent side of valve covered with fine tubercles.

Tergum (Pl. II. figs. 5, 6) elongated, about two and a half times as long as wide, apical part very slightly curved away from the scutal side, with a slight apico-basal ridge, situated a little less than half the width of the valve from the carinal margin; apex and basal angle acute. Two strong ridges extend from the apex to the scutal margin—one close to the oocludent margin, and the other to the middle of the scutal margin. Oocludent margin gently convex, a little more than half the length of the scutal margin, which is divided into two parts, which together form an obtuse angle; upper carinal margin weakly concave, less than half the length of the slightly convex lower carinal margin. Outer surface, except for the three main longitudinal ridges, comparatively smooth, although there are obscure longitudinal ridges. Inner surface with the upper carinal edge comparatively widely hollowed out, and the oocludent

edge narrowly raised; numerous fine and close-set tubercles are seen on the apical part of the valve, and these extend downwards along the occludent side to the upper part of the scutal margin.

Remarks. It is unfortunate that the carina has not been found, for it would be interesting to see how far the umbo was removed from the apex in this geologically early species. The scutum approaches that of *V. gabbi*, but differs in the rostral angle being more narrowly truncated, the lower half of the occludent margin more convex, and the upper half more concave, the ridge extending from the umbo to the tergo-lateral angle inclined upwards to a greater extent, and the fold near the upper occludent margin more prominent and placed closer to the margin. The scutum of *V. gabbi* is known to me, but not yet described.

The tergum differs mainly from that of *V. gabbi* in the upper carinal margin being comparatively shorter, and the lower carinal margin in being divided into two parts, together forming an obtuse angle. In these characters it approaches the species *V. darwinianum*, but it has not the numerous longitudinal ridges of that species.

STRAMENTIDÆ.

Loriculina ? *texanum*, sp. n. (Pl. II. fig. 7.)

Diagnosis.—A *Loriculina* ? with the tergum having V-shaped growth-lines, and with a wide longitudinal depression on the scutal side.

Distribution. Middle Albian, Fredericksburg group, Walnut formation: bed of Nolan Creek in big stream cut on north side of railroad, 4½ miles east of Nolanville, Bell Co., Texas.

Holotype.—An unique and nearly complete young individual, attached to an Ammonite—*Oxytropidoceras* sp.—preserved in the Bureau of Economic Geology, Texas University, No. 2500.

Description.—A young individual showing the right side uppermost, with only eleven vertical rows of scales on the peduncle: upper margin of scales comparatively strongly convex, the median row of scales much wider than those on either side. The right scutum has only the lower half preserved, and it is impossible to determine whether the umbo was removed from the apex or not; the edge of the left scutum is just projecting beyond the

right scutum: carinal latus represented only by the extreme base.

Tergum rhomboidal, with V-shaped growth-lines, the apices of the angles situated one-third the distance from the carinal margin; a striking feature is a wide longitudinal depression on the scutal side. Carinal latus obtusely triangular in shape, with the growth-lines extending straight across the valve parallel with the basal margin; the edge of the left carinal latus is just seen. No trace of carina.

Remarks.—Whether this species should be referred to the genus *Stramentum* or to *Loriculina* is an open question. In *Stramentum* (genotype *S. pulchellum* G. B. Sowerby, jun.) the scutum has a sub-central umbo, and the tergum has the growth-lines extending straight across the valve. In *Loriculina* (genotype *L. lævissima* von Zittel) the scutum has an apical umbo, and the tergum has the growth-lines V-shaped.

The present species has only the basal half of the scutum preserved, so one cannot say whether the umbo was apical or not, but the tergum has the growth-lines V-shaped, and this would tend to place it in the genus *Loriculina*.

One species described as *Stramentum* (*S. syriacum* Dames) from the ?Albian of Lebanon, Syria, however, has the tergum with V-shaped growth-lines. *S. syriacum* is known by a single specimen which is not well preserved, for it has been so much cleaned and rubbed that it is difficult to make out the details of the scutum, and further specimens may show that this is really a species of *Loriculina*. Certainly the present species *L. texanum*, sp. n., agrees more closely with *S. syriacum* in its characters, and it is of similar age. *L. texanum* differs from *S. syriacum* in having a distinct longitudinal depression on the scutal side of the tergum, and the V-shaped growth-lines have the apices of the angles situated nearer to the carinal margin. A comparison of the shape of the scales of the peduncle in the two species would be doubtful, since those of *S. syriacum* have been much cleaned and even carved, but the two outer rows of scales in *L. texanum* seem distinctly higher and not so wide.

In any case the Albian *L. texanum* is the only known representative of the Stramentidæ in N. America below

the Upper Senonian. *Stramentum* and *Squama* occur in the Upper Senonian of Kansas.

DECAPODA. BRACHYURA.

PROSOPONIDÆ.

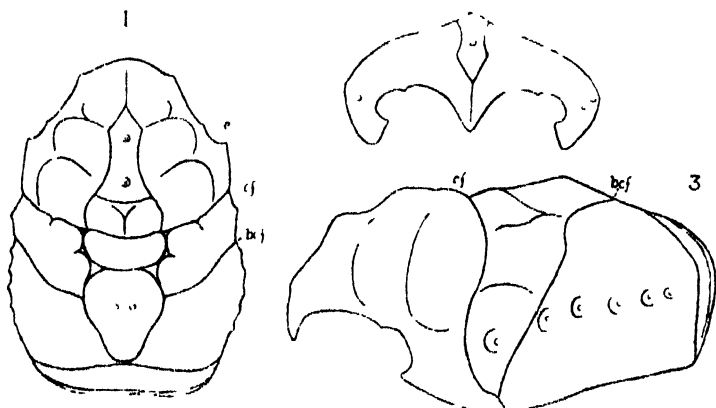
Vectis, gen. nov.

Diagnosis.—A Prosoponid with the cephalothorax narrowed in front, with deep eye-sockets, a row of six tubercles on each side forming an incipient lateral margin, and the cervical furrow directed posteriorly to near the outer margin.

Vectis wrighti, gen. and sp. n.

(Pl. II. figs. 8-10; text-figs. 1-3.)

Figs. 1-3.



Vectis wrighti, gen. and sp. n.

Outer, frontal and side views. $\times 12$ diam.

cf., cervical furrow; bcf., branchio cardiac furrow; e., eye-socket.

Diagnosis.—Same as for the genus.

Distribution.—Lower Aptian, Lower Greensand, "Crackers": Atherfield, Isle of Wight.

Holotype.—An unique cephalothorax collected by C. W. and E. V. Wright.

Measurements.—Length 3.5 mm., breadth 2.5 mm.

Description.—Although this crab is so minute, all its features are well developed and beautifully preserved,

Cephalothorax elongated, length nearly one and a half times the breadth, narrowed anteriorly, swollen posteriorly, steeply sloping in front, strongly convex transversely, sides almost vertical; front slightly worn, but it can be seen to be acutely angular, strongly downturned, with a median longitudinal depression; eye-sockets well developed; posterior margin slightly concave in the middle and convex at the sides; a transverse depression in front of the posterior margin serves to mark off an unusually wide posterior border. Outer surface entirely covered with fine tubercles. A line of six tubercles serve to form an incipient lateral margin. Outer orbital spine short, broken off in this specimen. Cardiac lobe heart-shaped, prominent, concave anteriorly, with two low bosses forming a transverse line in the middle of the lobe. Meso-gastric lobe broad posteriorly, and there divided off by a weak transverse furrow, and below this is a weak, median longitudinal furrow; upper two-thirds of meso-gastric lobe attenuated, with two prominent tubercles in a longitudinal line, and separated by a weak transverse furrow. Cervical furrow directed posteriorly towards the outer margin, and the branchio-cardiac furrow leads into it near the outer margin.

Remarks.—The genus *Vectis* approaches *Prosopon* in the cephalothorax narrowing anteriorly, but it differs in having well-developed eye-sockets. On the other hand, *Pithonoton* agrees with *Vectis* in having well-developed eye-sockets, but differs in the cephalothorax being wider anteriorly, and in having a lateral margin anterior to the branchio-cardiac furrow, for it extends only from the antero-lateral spine to near the branchio-cardiac furrow; instead *Vectis* has an incipient lateral margin of which five of the six tubercles forming it are posterior to the branchio-cardiac furrow. *Vectis* differs from both *Prosopon* and *Pithonoton* in the cervical furrow being directed posteriorly towards the outer margin.

EXPLANATION OF PLATE II.

Arcoscalpellum conptum (Withers).

Lower Aptian, Lower Greensand, "Crackers":
Atherfield, Isle of Wight.

Figs. 1, 2. Carina. Outer and side views. $\times 4$ diam. C. W. and E. V. Wright collection.

Virgiscalpellum wrighti, sp. n.

(Same horizon and locality as Figs. 1, 2.)

Figs. 3-6. Scutum (Holotype, figs. 3, 4) and tergum (Paratype, figs. 5, 6). Outer and inner views. $\times 4$ diam. C. W. and E. V. Wright collection.

Loriculina ? *tezanum*, sp. n.

Middle Albian, Fredericksburg group, Walnut formation.
E. of Nolanville, Bell Co., Texas.

Fig. 7. Nearly complete young individual. Holotype $\times 6$ diam. Bureau of Economic Geology, Texas University, No. 2500.

Vectis wrighti, gen. and sp. n.

(Same horizon and locality as Figs. 1, 2.)

Figs. 8-10. Cephalothorax. Holotype $\times 10$ diam. Fig. 8, outer view; fig. 9, side view; fig. 10, fronto-orbital view to show downturned front (*f*) and eye-socket (*e*). C. W. and E. V. Wright collection.

LVII.—*Stray Notes on Anoplura.*

By G. H. E. HOPKINS, M.A.*

1. *The Hosts of some Species described or recorded by Ferris.*

FERRIS (1920-1935) recorded a number of species of Anoplura from skins in the United States National Museum. Some of these skins had not been fully determined when Ferris wrote, and in one or two instances the names given by Ferris were evidently distorted. In response to my enquiry, Dr. Remington Kellogg, Curator of the Division of Mammals at the United States National Museum, has most kindly supplied me with further information about some of these skins, which I now put on record for the benefit of other students. The names are mostly in the form now given on the labels of the skins. This further information would hardly have been obtainable had not Ferris very wisely recorded the museum-numbers of the skins.

U.S.N.M. skin 16413, without data, was recorded by Ferris (p. 498 †) as *Arctocephalus* sp.; the louse recorded from it is an undescribed *Antarctophthirus*. The present

* Published by permission of the Director of Medical Services, Uganda.

† The page references given in this paper are to the consecutive pagination at the bottom of the pages in Ferris's work.

determination of the skin (whose number was incorrectly transcribed, being actually 16463) is *Arctocephalus falklandicus*.

U.S.N.M. 48477, "*Scutisorex* sp., Medjie," is *Scutisorex congenericus* Thomas. Ferris (p. 192) records it as a host of *Polyplax reclinata* (Nitzsch) and, by a *lapsus calami*, states that the skin is in the American Museum of Natural History.

U.S.N.M. 63471, "*Pithecus* sp., Kashmir," is *Macaca mulatta*, the Rhesus monkey. This skin is mentioned by Ferris (p. 509) as a host of *Pedicinus longiceps* Piaget. It is convenient to deal here with other skins formerly determined as *Pithecus* sp., instead of in their numerical order. U.S.N.M. 114559, West Sumatra, is *Macaca malsabari*; U.S.N.M. 104438, Chance Island, Mergui Archipelago, is *Macaca andamensis*; U.S.N.M. 104440, also from Chance Island, is *Macaca insulana*. The first two of these are given (Ferris, p. 509) as hosts of *Pedicinus longiceps* Piaget, and the last (as "10440"; see Ferris, p. 522) as a host of *Pedicinus eurygaster* (Burmeister).

U.S.N.M. 94164, "*Eligmodontia collisæ*, Goya, Argentina." Although this skin, which Ferris (p. 72) records as a host of *Hoplopleura hesperomydis* (Osborn), was fully determined, I asked Dr. Kellogg about it because Ellerman lists no species of this name. Dr. Kellogg kindly informs me that it is a specimen of *Hesperomys callosus callosus* (Rengger), and that the determination on the label is so scrawled that it would be easy to misread it.

U.S.N.M. 114084, "*Funambulus tristriatus tristriatus*, Colombo, Ceylon." I would not have questioned this name but for the fact that Ellerman records no form of *F. tristriatus* from Ceylon, but the skin turns out to be *Funambulus palmarum favonicus*. Ferris mentions it (p. 250) as a host of *Neohæmatopinus echinatus* (Neumann). He also (p. 26) describes *Enderleinellus platyspicatus* Ferris from "*Funambulus tristriatus*, Colombo, Ceylon"; although, in this latter instance, he fails to give the museum number, it is a safe assumption that the types of *E. platyspicatus* were collected from the same skin.

U.S.N.M. 124254, "*Tamias* sp., Tenasserim, Telok Besar." This skin, from which Ferris (p. 114) obtained some of his specimens of *Hoplopleura erismata* Ferris, is a specimen of *Tamias novemlineatus*.

U.S.N.M. 129396, "*Synaptomys* sp., Athabasca Landing, Canada." Ferris (p. 65) records obtaining *Hoplopleura acanthopus acanthopus* (Burmeister) from this skin of *Synaptomys borealis borealis*.

U.S.N.M. 194486, "*Sciurus* sp., Buena Vista, Bolivia." A specimen of *Urosciurus pyrrhonotus castus*. Ferris (p. 111) obtained specimens of *Hoplopleura sciuricola* Ferris from this skin.

U.S.N.M. 194500, "*Rhidipomys* sp., Rio San Miguel, Peru." Ferris (p. 73) obtained part of the type-series of *Hoplopleura angulata* Ferris from this skin which is *Rhidipomys leucodactylus*.

U.S.N.M. 194544, "*Euneomys* sp., La Raya Pass, Peru." Ferris (p. 77) records *Hoplopleura affinis* (Burm.) from this skin, which is *Euneomys pictus*, now known as *Phyllotis (Auliscomys) pictus* (Thomas).

U.S.N.M. 194701, "*Oxymycterus* sp., Occabamba Pass, Peru." The determination of this skin is of special importance because Ferris (p. 122) obtained from it the types of *Hoplopleura oxymycteri* Ferris. It is *Oxymycterus paramensis*.

U.S.N.M. 198750, "*Phaiomys* sp., East Ladak, Kashmir." This skin, type-host of *Hoplopleura phaiomydis* Ferris (p. 120), is *Phaiomys blythi*.

U.S.N.M. 199559, "*Rhinosciurus* sp., Hsing-lung-shan; 65 miles north-east of Peking, China." This skin is not a *Rhinosciurus*, but *Tamiops vestitus*. In view of the discrepancy and the importance of this specimen, as the skin from which were obtained the types of *Hoplopleura distorta* Ferris, I made further enquiries from Dr. Kellogg. He took a great deal of trouble over the matter, and informs me that, not only do the data of U.S.N.M. 199559 correspond with those given by Ferris (p. 115), but at the time when Prof. Ferris examined the collection the only specimens of *Rhinosciurus* in the collection were numbered 104708, 104971, 104972, 113066, 114414, and possibly 171977. None of these numbers could possibly be confused with 199559, so that it seems certain that the data of the skin were correctly given by Ferris, but that the determination was entirely wrong. There is nothing to suggest how the mistake arose.

U.S.N.M. 201120, "*Crocidura* sp., Atochebal, Valley of Kashmir." Ferris (p. 192) recorded *Polyplax reclinata*

(Nitzsch) from this skin and figured the sternal and pleural plates of a female obtained from it (fig. 120, C and G, p. 190). These structures show considerable differences from the same plates of *P. reclinata* and the specimen figured has been made the type of *Polyplux deltoides* Fahrenholz (1938, p. 256). The skin is a specimen of *Suncus caeruleus* ssp.

2. The types of *Pedicinus obtusus* (Rudow).

Ferris (1920-1935, pp. 507, 510, 526) mentions a slide of *Pedicinus* received by him from the Hamburg Museum and labelled "*Semnopithecus maurus*, A. Poppe det. 1881/2." He points out the possibility that this slide contains the types of *Hæmatopinus obtusus* Rudow, because the host is the same and many of Rudow's types are in the Hamburg Museum. He refuses to recognise *obtusum*, however, on the grounds that there is no certainty that the specimens on the slide are Rudow's types, nor that the host was correctly determined*, and that there is the possibility that Rudow was dealing with some other species of *Pedicinus* (perhaps *P. eurygaster*), since Rudow's description is useless. The specimens on the Hamburg slide were found by Ferris to be inseparable from *Pedicinus longiceps* Piaget, which is in part from the same host (*Semnopithecus maurus* and *S. pruinosa* are both synonyms of *S. cristata*).

Ferris, rightly, does not regard the fact that the specimens on the Hamburg slide were determined by Poppe as any bar to their being Rudow's types, because Rudow left much of his material not labelled with the determination: I agree with Ferris that there can be no certainty as to whether these specimens are the types of *obtusum*. But if they are not the types, then the types are lost, and I disagree entirely with the way in which Ferris treats Rudow's name. The correct procedure with regard to an insufficiently described species of which the types are lost is not to reject the name but to tie it down to a definite foundation by erecting neotypes for it. This is only common sense, for otherwise we would have to reject almost every name proposed for a louse prior to the middle of the 19th century, the types being almost invariably lost and the descriptions usually grossly

* This applies with equal force to the hosts of *Pedicinus longiceps* Piaget, which Ferris recognises.

insufficient by modern standards. Almost all writers recognise this principle by implication, for they use material from the same host to interpret the old names, though generally without regularising the position by erecting neotypes from such material. This failure to erect neotypes leaves the old names open to individual interpretation and consequent chaos, as is very well exemplified by the Mallophaga of the domestic goat, where the name *Trichodectes limbatus* Gervais has been applied by different authors to every one of the three species concerned (Hopkins, 1942, pp. 446-452).

In the case of *obtusus* we are unusually favourably placed for the erection of neotypes, because there is a distinct probability that the Hamburg specimens are part of Rudow's original type-series. I therefore formally designate the specimens on the slide seen by Ferris and labelled "*Semnopithecus maurus*, A. Poppe det. 1881/2," as neo-cotypes of *Hæmatopinus obtusus* Rudow, 1869; from these specimens lectotypes should be selected.

3. The Hosts of the Genus *Ratemia*.

The very peculiar genus *Ratemia* only includes one described species, *R. squamulata* (Neumann), which was described from three females collected at Dire-Daua, Abyssinia, "sans indication d'hôte" (Neumann, 1911, p. 402). Until the event recorded in the present note the genus had not been obtained again and the host remained unknown. It was, therefore, with gratified amazement that I found, in determining some Anoplura collected by myself in Uganda, that I had rediscovered *Ratemia*, my amazement being due to the fact that the host was so familiar an animal as the domestic ass or donkey, *Equus (Asinus) asinus* Linn.

The lice were obtained by dissolving the hair from the skin (kindly sent to me by Mr. T. R. F. Cox) of a donkey which died in March 1942 at Lira, Lango District, Uganda. Several hundreds of the lice were present, leaving no room for doubt that the ass was a genuine host of the parasite, and the series includes many specimens of the hitherto unknown male. I cannot distinguish the species from *Ratemia squamulata* (Neumann), but I have submitted a large part of the material to Dr. F. L. Werneck for further examination, and in the hope that he will eventually describe the male.

Confirmation of the natural occurrence of the genus *Ratemia* on the Equidæ is also available, for Mr. G. R. Cunningham van Someren later sent me the skin of a wild Burchell's zebra, *Equus (Hippotigris) burchelli böhmi* Matschie, shot in August 1943 on the Athi Plains, near Nairobi, Kenya, and from this skin, using the same technique, I obtained a further series of one male and fourteen females of *Ratemia*. These lice, also, have been submitted to Dr. Werneck.

Since *Ratemia* is now shown to occur on both ass and zebra, there seems every reason to expect that it will eventually be found to infest all the members of the Equidæ, and this raises the question of the host of Neumann's original material. It is not at all probable that this host was a zebra, because the most northerly members of this group, *Equus (Hippotigris) burchelli jallæ* (Camerano) and *Equus (Dolichohippus) g. grevyi* Oustalet, are not known to occur north of Lake Zwai, about 100 miles south-west of Dire-Daua. Asses and horses are, however, abundant in Abyssinia, and it was probably from a member of one of these two species that the types of *R. squamulata* were obtained.

4. *The Hosts of certain Seal-Lice.*

Ferris (1920-1935, pp. 476-480) regards all the names which have been applied to members of the genus *Echinophthirius* as being synonymical with *E. horridus* (von Olfers). In this opinion he may be right, but analogy with other genera suggests the possibility that it may prove necessary to divide the genus again into several species or subspecies. An essential preliminary to any such subdivision (which I do not myself intend to undertake) is to establish the type-hosts of the various names which have been used in the genus, especially as erroneous statements have been made about one of them.

The earliest name applied to a member of the genus is *Pediculus horridus* von Olfers (1816, p. 84); the host is definitely stated to have been *Phoca vitulina*. This is followed by *P. phocæ* Lucas (1834, Cl. ix. pl. 121, f. 12), from "phoque" and *P. setosus* Burmeister (1838, p. [6]), stated to be from *Phoca grænlantica*; these two names must be considered together. According to Freund (1928), Gervais amplified the host-data of Lucas's material to *Phoca vitulina* from Paris Zoo and the types were still

in Paris when Freund wrote, but meanwhile Burmeister had assumed Lucas's "phoque" to be *P. grælandica* and named the louse *P. setosus*. The obvious assumption is that Burmeister had no material and merely renamed *P. phocæ* Lucas, which is supported by the fact that Burmeister gives no measurements as he does in practically all other instances. The point is not of great importance, because *Pediculus setosus* Burmeister 1838 is pre-occupied by *P. setosus* von Olfers 1816, the only really important fact being that *P. phocæ* Lucas is from *Phoca vitulina* and is therefore a synonym of *Echinophthirius horridus* (von Olfers).

Hæmatopinus annulatus Schilling (Gurlt. 1857, p. 281, and 1878, p. 187) from *Phoca hispida*, can be ignored, because it is a *nomen nudum* and therefore has no standing in nomenclature. The next name in the genus is *Echinophthirius grælandicus* Becher (1886, p. 60), from *Phoca grælandica*, followed by *E. sericans* Meinert (1897, p. 177), from *Phoca grælandica* in Greenland. The only name which has been added since Ferris wrote is *Echinophthirius horridus baicalensis* Ass (1935, p. 25), from "Baikalrobbe" [*Phoca sibirica*].

On the assumption, therefore, that the forms of *Echinophthirius* found on different species of seals are distinguishable, the valid names are *E. horridus* (von Olfers) for the form on *Phoca vitulina*, *E. grælandicus* Becher for that on *P. grælandica*, and *E. h. baicalensis* Ass for that on *P. sibirica*.

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LVIII.—On Two new Varieties of *Terrestrial Isopoda*.
By WALTER E. COLLINGE, D.Sc.

I HAVE recently received from Dr. R. S. Bagnall a small collection of *Trichoniscids* from Ireland and elsewhere, amongst which there are two very striking and hitherto unknown forms, viz., a variety of *Trichoniscus vividus* (Koch) from Ireland and one of *Haplophthalmus danicus* Budde-Lund from Co. Durham.

Little attention has hitherto been paid to the members of this last-mentioned genus, possibly owing to their small size, 3 to 4 mm.

Owing to the fact that there is only a single specimen of the *Haplophthalmid* I refrain from describing it as a new species, which both Dr. Bagnall and I think it is, so for the present regard it only as a variety.

Trichoniscus vividus (Koch).

Deutsch. Crust. 1840 *.

Var. *perlatus*, nov.

Whole of dorsum a dark, dull pearly colour.

Locality.—Feeagh, Co. Mayo. On the shore, 28. viii. 1944 (V. L.).

Haplophthalmus danicus B.-L.

Nat. Tidask. 1870, vii. p. 228.

Var. *bagnalli*, nov.

The most striking differences from *H. danicus* are the elongated form of the body, it measures 5 mm. in length, the more globular form of the cephalon, the stouter antennæ and the shorter exopodites of the uropoda. The tubercles on the dorsal surface of the body are much larger, but flatter and fewer in number. The colour is a bright golden yellow.

The habitat is also of interest, "among moorland sphagnum at Edmondbyers, Co. Durham" (R. S. Bagnall).

I have much pleasure in associating with this interesting form the name of Dr. R. S. Bagnall, whose work has proved so fertile.

* Dr. Isabella Gordon informs me that according to Sherborn this should be 1841.



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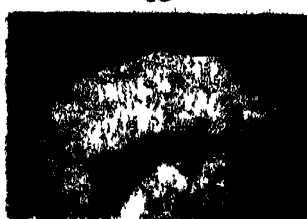


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M. G. Sawyers, photo.

CRETACEOUS CIRRIPEDES and CRAB.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY

[ELEVENTH SERIES.]

No. 93. SEPTEMBER 1945.

LIX.—*A new Genus of Fruit-Bat and a new Squirrel, from Celebes.* By R. W. HAYMAN, Department of Zoology, British Museum (Natural History).

IN 1939 a large collection of mammals obtained during the previous year in the Dutch East Indies by Mr. W. J. C. Frost was received by the British Museum. It contained no bats. Recently, however, Mr. Frost, on reaching England after four years in a prison camp at Singapore, found a few more small mammals from Tamalanti, West Celebes (one of the localities represented in the main collection), which had been overlooked earlier. Among these specimens is a series of *Callosciurus* representing an apparently new race, and a single skin and skull of a fruit-bat which I am unable to allocate to any of the known genera, so distinctive are its external, cranial and dental characters. I propose for it the name

NEOPTERYX, gen. nov.

Diagnosis.—A moderate sized member of the Pteropodine subfamily, with index-finger clawless, tail absent, wings attached very close to the central line of back, which is furred, interfemoral membrane narrow, absent centrally. The genotype has the fasciæ of the wing membranes few in number and heavily pigmented with black, forming a prominent pattern on the brown membranes.

Skull Pteropine in general features, but modified by the sharp narrowing of the anterior portion of the rostrum so that the maxillary tooth-rows converge forward at an angle of about 30 deg., while the palatal breadth between the canines is only half the breadth between the posterior molars. Post-dental palate lengthened and pierced by two large elliptical vacuities. Occipital region deflected and tubular as in most species of *Pteropus*. Mandible with ramus very narrow and lengthened in striking contrast with the high and broad coronoid process, high condyle, and broad angular process.

Dental formula (using Andersen's terminology) :

$$\frac{i^1 i^2 c p^3 p^4 m^1 m^2}{i_1 i_2 c p_1 p_3 p_4 m_1 m_2 m_3} = 32.$$

Teeth strongly reduced, cheek teeth so modified by the reduction or disappearance of basal ledges that they are, with one exception, at least as broad as long, in most cases broader. m^2 and m_3 are larger in proportion to the other cheek teeth than is usual in the subfamily, and all cheek teeth are well spaced at fairly even distances from each other. The third lower premolar is the largest mandibular cheek tooth, whereas in the Megachiroptera generally the rule is that the second lower premolar is the largest. Evidence of the unusual extent of the reduction of the cheek teeth is provided by the disappearance in p^3 and m^1 of the second root normal in the larger cheek teeth in the Chiroptera. The teeth are so worn that it is difficult to distinguish traces of any cusps beyond the antero-external elevation common to the larger cheek teeth.

In external characters the absence of claw on index finger, combined with absence of tail, is a diagnostic feature of *Neopteryx* in the subfamily Pteropodinae. The only other fruit-bat combining these two features is *Nesonycteris* in the Macroglossinae, differing widely from *Neopteryx* in skull and tooth characters. The dental formula given assumes that the minute p^1 of *Rousettus* and *Pteropus*, often deciduous, is not present at an earlier stage, but even if it were, the extraordinary shortening and simplification of the cheek teeth, combined with their regular spacing and tendency towards approximation in size, would distinguish the dentition of *Neopteryx* from that of any other fruit-bat. The conspicuous narrowing of the anterior portion of the palate, combined with the

weakening of the teeth to such an extent (the canines both above and below are remarkably short and weak) suggests a special adaptation to a particular type of food supply.

The genotype is

Neopteryx frosti, sp. n.

Type.—Adult female skin and skull, Tamalanti, West Celebes, 3300 ft. Collected 1938 or 1939 by W. J. C. Frost. B.M. No. 40.691 k.

External characters.—Size medium, forearm 110 mm. Pteropine in general appearance, with muzzle long, ears small and naked. Pollex large, with strongly developed claw. Index finger with the normal three phalanges, but without the slightest indication of a claw. Wings attached very close to the median line of the back, and on the foot to between the bases of first and second toes. Calcar short, interfemoral membrane a narrow flange commencing behind femur. No external tail. Hind feet with well developed claws. Fifth metacarpal distinctly longer than fourth, which is slightly longer than third. Fur short and thick, with many longer hairs on fore part of body. A band of sleek adpressed fur about 30 mm. wide, clothing the median line of back and the adjoining parts of wing membranes. Forearm naked above and below. Tibia naked above and below. Membranes in general un haired except for a thin scattering of short hairs below on the antebrachium and for a short distance outside the forearm.

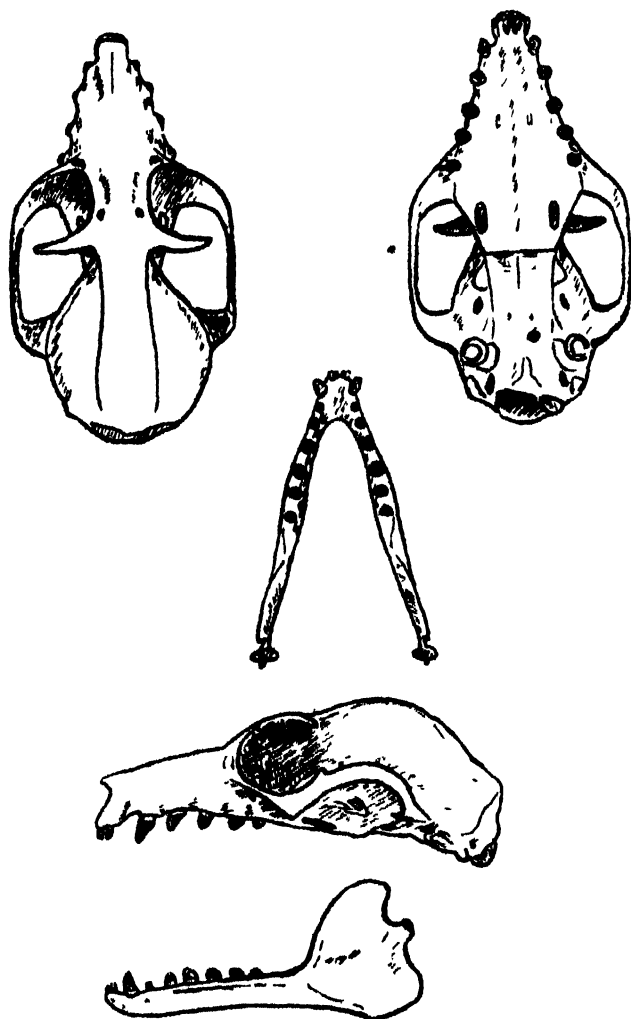
Colour. — (Ridgway standards.) Mantle uniformly tawny, with the bases of the hairs lighter, olive buff. On lumbar region the fur darkening gradually to warm sepia, darkest on lower back and thighs. No line of demarcation between mantle and lower back. Below, general colour avellaneous, with bases of hairs vinaceous buff. Between the legs there is a sharp line of demarcation at the junction of the sepia of lower back and the pale colour of the underside. Muzzle with conspicuous contrasting pattern of sepia brown and creamy white. A sepia patch on either side of the muzzle, extending from the nostrils back to and around the eyes; a narrow creamy-white stripe on centre of muzzle from nostrils, broadening abruptly between the eyes and ending at the front of the tawny forehead. At the angle of the

mouth on each side of the head a large creamy-white patch which narrows posteriorly to form a streak passing below the eye and ending halfway between the eye and the anterior base of the ear. From this patch at the angle of the mouth a narrow streak of the same colour passes forward along the upper lip to the base of the nostrils, and also less distinctively along the margin of the lower lip almost to the chin. A sepia border forms a lower margin to the creamy-white cheek patch, the sepia lightening somewhat as it passes below to chin and throat, where it pales into the avellaneous of the rest of the underside.

The wing membranes are of a uniform vandyke brown colour, with a bold contrasting pattern over the plagiopatagium of heavy black lines formed by the pigmentation of the thickened fasciæ, of which eight occur on the plagiopatagium, extending forward from the rear edge of the membrane. Between the fourth and fifth fingers two more, and between the third and fourth one more of these heavy black lines occur. Some are joined medially by connecting transverse fasciæ, equally thick and black. In the folded wing the general effect is that of a broad reticulation, somewhat reminiscent of that found in the Vespertilionid bat, *Glauconycteris variegata papilio*, although in the latter the veining is much more profuse and is on a far paler membrane. In other fruit-bats the only suggestion of such a type of pattern of which I am aware is that found on a reduced scale of intensity in *Pteropus conspicillatus*.

Skull.—Generally Pteropine in affinities, with moderately deflected brain case, tubular occipital region, large rounded orbits, well developed post-orbital processes with a small post-orbital process on the zygoma. Front of orbit vertically above posterior margin of m^1 . Zygomatic arches strongly curved upward, but not bowed outward, parallel with the longitudinal axis of the skull. Post-orbital foramina very small, post-orbital constriction narrow. Temporal ridges slight, well separated throughout their length. Rostrum sharply narrowed anteriorly, this being most noticeable in palatal view. Palate wide at posterior molars, narrowing sharply forward so that the maxillary tooth-rows converge at an approximate angle of 30 deg. Palatal breadth between

inner bases of canines barely half the breadth between inner bases of the posterior molars. Post-dental palate long, narrowing sharply, its posterior border straight,



Type skull of *Neopteryx frosti*. $\times 1$.

and its surface pierced near the lateral margins, in a position halfway between m^2 and palation, by two comparatively large elliptical vacuities, each about 5 mm.

long and 2 mm. wide. Mesopterygoid fossa wide. Tympanic bullæ annular, no special peculiarities about the basi-occipital region.

Mandible long, rami very narrow, concave below, slightly bent inward towards the canines, symphysis short and at an acute angle to alveolar line. Coronoid process very high and broad, steeply ascending, condyle high above alveolar line, angular process deep and square-cut. The contrast between the weak, long and very narrow ramus and the particularly high and broad posterior portion of the mandible is most striking, and is in strong contrast with the usual Megachiropteran association of weak and narrow ramus with low and sloping coronoid, low condyle and obsolescent angular process, or the converse association of high and broad posterior portion of mandible with short and deep ramus.

Teeth.—The whole dentition is peculiarly weak and degenerate. The upper incisors are less reduced in size proportionately than the rest of the teeth, but are quite simple, terete, with crowns almost conical, smoothly rounded above. They are subequal in size, closely grouped in a sharp curve round the well advanced anterior edge of the premaxillæ. Each incisor is separated from its fellows by a space slightly less than its own diameter. There is a diastema, equal to the combined space occupied by any two incisors, between i^2 and the canine. The latter is very weak, slender, with no trace of any anterior groove or of cingulum, and with a weak but definite secondary basal cusp.

The cheek teeth are distinguished by their degenerate condition, shortness, tendency towards approximation in size, and almost equal spacing, each interspace being roughly equal to the diameter of the canine. There is no trace in the alveolus of a deciduous p^1 . A feature of the maxillary cheek teeth is that the crowns are never less broad than long, and are mostly broader. Although they are very much worn down, the crowns, although very smooth and rounded, have a recognizable antero-external elevation and show traces of the remnants of a lower antero-internal one. There is only the slightest trace of a posterior basal ledge in the largest teeth, and no trace of it in the smaller. p^3 has the longest shaft, p^4 and m^1 are approximately equal in height, and all

three are almost equal in crown area and form. m^2 is half the height and has less than half the crown area of the preceding teeth.

The lower incisors are strongly differentiated in size, i_1 being about half the height and one-fourth the bulk of i_2 , and are terete in form. i_1 and i_2 are only narrowly separated from each other, but there is a wider central gap between the inner pair. i_2 is separated from the base of the canine by a narrow diastema. The lower canines are particularly weak and short, ungrooved, without cingulum, and are directed outward. In the lower cheek teeth there is a more marked differentiation in size than in the maxillary teeth, but the spacing remains fairly even. p_1 is subequal in size to i_2 and is well separated from the canine; p_3 is about twice the height and three times the bulk of p_1 , while p_4 is the highest and largest tooth. In crown area m_1 is equal to p_4 , while m_2 and m_3 are progressively reduced. All the mandibular cheek teeth are smoothly rounded by wear, and show little more than a tendency towards an antero-external elevation. The narrowness of the anterior portion of the mandible, together with the corresponding weakness of the canines, give a peculiarly degenerate appearance to this portion.

Measurements.—External measurements were taken from the relaxed skin before making up. Head and body 155; hind foot (s.u.) 33; ear 20; forearm 110; pollex (s.u.) 32; second metacarpal 52, third 75, fourth 77, fifth 82; calcar 12.

Skull.—Greatest length 54; condylobasal length 53; zygomatic breadth 28; breadth of brain-case at root of zygoma 22; rostrum (front of orbit to tip of nasals) 19.5; diameter of orbit 13.5; interorbital breadth 8; post-orbital constriction 9; palatal length 31; palatal breadth across outer roots of canines 9, across outer roots of posterior molars 17; length of post-dental palate 10.5; width of mesopterygoid fossa 10; post-dental palatal vacuities 5 long, 2 wide; greatest height of skull 22. Mandible: greatest length 42; height at coronoid 19; least depth of ramus 5.

Teeth. upper tooth-row, $c-m^2$, 17; lower tooth-row, $c-m_3$, 18.5; upper incisors, combined width 5; p^3 length 2, width 2.5; p^4 length 2.5; width 3; m^1 length

2.5, width 2.8; m^2 length 2, width 2.2; p_1 length 1, width 1; p_3 length 2, width 2; p_4 length 2.8, width 2.8; m_1 length 2.8, width 2.5; m_2 length 2.2, width 2.2; m_3 length 2, width 2.

Summary.—*Neopteryx* constitutes the fifth known genus in the Megachiroptera lacking a claw on the index finger. The absence of tail distinguishes it at once externally from *Dobsonia*, *Eonycteris* and *Notopteris*, which all lack the index claw, while *Nesonycteris*, the only fruit-bat previously known to combine absence of tail with absence of index claw, belongs to the MacroGLOSSINE subfamily and has distinctive cranial and dental characters. The sharply narrowed rostrum and degenerate dentition together distinguish the skull from that of any other fruit-bat. The bold head striping of *Neopteryx frosti* is suggestive of that found in two other Celebean fruit-bats, *Pteropus personatus* and *Styloctenium wallacei*, as also in *Pteropus capistratus* and the dwarf genera *Scotonycteris* and *Casinycteris* from other areas. The heavy black pigmentation of the thickened fasciæ of the wing membranes gives the animal a very distinctive appearance.

It would appear that this new genus and species represents a specialized branch of the Pteropine group. Incidentally, the freshly relaxed skin had in full measure the characteristic rank odour typical of the Pteropi. Its discovery is an event with which I am glad to link the name of Mr. W. J. C. Frost, who has done much to enlarge the British Museum collections of Oriental and Austro-Malayan mammals in recent years.

Callosciurus leucomus hirsutus, subsp. n.

The new squirrel obtained by Mr. Frost is a member of the peculiar *leucomus* group, confined, so far as is known, to Celebes. The majority of the named forms in the group have tufted ears, the tail tends to be shorter than in the majority of species in the genus, and the skull, in typical *leucomus* and such other forms as have been critically examined, is characterized by the relative shortness of palate and orbit, the latter in addition being placed so far back that the lacrymal is vertically above the middle of the tooth-row.

Type.—Male, skin and skull, Tamalanti, West Celebes, 3,300 ft. Collected 1938 or 1939 by W. J. C. Frost. B.M. No. 40.691 g.

Diagnosis.—Slightly smaller, according to available skull measurements, than typical *leucomus*; general colour above, a uniform warm grizzled mixture of amber-brown and black, below, pale buffish mixed with grey, the buff colouring most clear and intense on throat and chest. The underside very distinct from the clear brick red of *leucomus* and other related forms, but sharing this distinction with *Callosciurus topapuensis* Roux (the nearest form geographically). Ears clothed above with black hairs, forming a distinct tuft contrasting with the colour of head and body. Tail short, of same general hue as body, but with long terminal pencil or tuft of all black hairs. Coat very full and shaggy.

Colour (of type and five paratypes).—Head, neck, whole of upper surface of body, limbs and feet a warm mixture of amber brown and black, the general effect distinctly brown as compared with the olivaceous greeny-grey of typical *leucomus*. The basal portion of the hair is dark slate, terminating in alternate bands of black and amber brown. In the tail the hairs differ chiefly in being dirty buff basally instead of grey, and the amber-brown bands on the hairs tend to be a little brighter than on the body. The very long tail tuft (up to 70 mm.) is composed altogether of black hairs. The throat and chest hairs have bases of a paler grey than on the upper surface, and terminate in cinnamon buff, forming a pale wash over the region named. In the inguinal region the buffish wash is far less definite, and the general hue is not markedly different from the upper surface of the body. The ears are clothed above with black hairs forming a loose tuft, contrasting with a narrow line of short ochraceous hairs on the anterior margin, and contrasting also with the colour of head and body.

Skull.—The skulls of the type and one paratype (the remainder are incomplete) show the peculiarly shortened orbit of the *leucomus* group, set so far back that the lacrymal is above the centre of the tooth-row and the tip of the postorbital process is not very far forward of the front of the posterior zygomatic root. The palate is comparatively short. The orbit is about 26 per cent., the palate 44, of the occipito-nasal length.

Measurements.—All measurements of the new form are taken from the relaxed skins before making up. It seems necessary to make considerable allowances for stretching

in skinning, since the head and body figures prove greater than might be expected from the cranial length. In comparing these measurements with those given by earlier authors dealing with members of this group, it is necessary to bear in mind that in some cases they have apparently included the terminal pencil, the tuft, and the claws, in the figures they have given for tail, ear and hind foot respectively. Hence accurate comparisons of size are not generally possible on the published figures.

Type: head and body 185, tail 115, with tuft 185, hind foot 36, ear 15. Averages and extremes of six specimens, including type: head and body 178 (163-195); tail 131 (115-158); with tuft 199 (179-223); hind foot 38 (36-40); ear 14.8 (14-15).

Skull of type: occipito-nasal length 42; condylo-basal length 38; zygomatic breadth 26; palatal length 18.4; nasals 12; inter-orbital width 15; length of orbit 11.4; upper tooth-row 8; breadth across last upper molars 9.

Remarks.—*Callosciurus leucomus hirsutus* is strikingly different from *C. leucomus leucomus* of N.E. Celebes in colour, but is here treated as a subspecies to indicate relationship, in view of its obvious affinities as shown by the skull. *C. l. occidentalis* Meyer, of the western portion of the northern peninsula of Celebes, is not stated by the author to have differed in any way from typical *leucomus* except in the absence of the white post-auricular patches. *C. topapuensis* Roux, from Central Celebes, is the only member of the group resembling the present form in its greyish, washed with yellow, underside. But *topapuensis* is said to have ear tufts coloured as the head, and to have the sides of the body, and the limbs, a lighter, more yellowish, tone than the back, two characters which definitely do not apply to the Tamalanti form. The shaggy coat is particularly long and full in the latter animal, and in conjunction with the tufted ears and particularly long terminal tail tuft suggested the sub-specific name.

LX.—*New or little-known Tipulidæ (Diptera).*—LXXV.
Neotropical Species. By CHARLES P. ALEXANDER,
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At this time I am considering species collected in Ecuador by Messrs F. Martin Brown, David Laddey, and William Clarke-Macintyre, and in Peru by Messrs. Pedro Paprzycki, Raymond Shannon, J. Adger Smyth, and Felix Woytkowski, to whom I am very greatly indebted for their continued interest in collecting and preserving their fragile flies. The types of the novelties are preserved in my personal collection.

Brachypremna illudens, sp. n.

Allied to *arcuaria*; size small (wing, male, 13 mm.); general coloration of thorax almost uniformly dark brown; femora and tibiæ dark brown, the genua very narrowly brightened; wings strongly suffused with brown, variegated by the large darker brown stigma and conspicuous whitened prestigmal and poststigmal areas; abdomen black, the basal rings of the segments pale; male hypopygium with the tergal lobes glabrous, broadly subtruncate at tips; lower dististyle unusually broad, inner style with the entire outer margin produced into a broad-based triangle, the apex of style truncate, terminating in about three spinous blades or points; gonapophyses greatly expanded into flattened blades.

Male.—Length about 11 mm.; wing 13 mm.

Female.—Length about 11 mm.; wing 12 mm.

Frontal prolongation of head brown above, the ventral half darker; nasus elongate, blackened; palpi uniformly black. Antennæ 10-segmented; scape and flagellum blackened, the pedicel obscure yellow. Head dark brown, sparsely pruinose.

Thorax almost uniformly dark brown, the præscutum with a capillary median grey line that becomes a little more expanded before the suture; scutellum and mediotergite somewhat more pruinose. Halteres elongate, stem obscure yellow, knob dark brown. Legs with the coxæ dark brown; trochanters a trifle paler; femora dark brown, more blackened immediately before the very

narrowly whitened apex ; tibiae black, the extreme base vaguely whitened ; basitarsi dark brown, the remainder of tarsi paling to very pale brown or yellowish brown ; claws (male) elongate, each with two teeth, the basal one more slender. Wings with a very strong brownish suffusion that is variegated almost solely by the darker brown stigma and by conspicuous whitish prestigmal and poststigmal areas ; cells *C* and *Sc* a trifle darker ; a small dusky cloud over anterior cord and very vague darkenings over *Cu* and *m-cu* ; no pale droplets or other markings elsewhere on membrane ; veins *M*₂ to *M*₄, inclusive, with the usual pale obliterative tips, remaining veins dark brown. Venation : *R*₁₊₂ entirely pale ; *Rs* relatively short, strongly arcuated or bent at origin ; veins *M*₁ and *M*₂ subparallel for most of their lengths ; cell 2nd *A* narrow.

Abdomen black, the segments with the bases narrowly ringed with yellowish white ; tergite two with a further similar ring at near mid-length ; sternites with the pale bases even more extensive, continued down the sides of each sclerite to isolate a broadly triangular dark brown mark that covers the entire posterior border of each segment. Male hypopygium with the tergite narrowed posteriorly, the entire outer margin further produced into a yellow glabrous border that is rather weakly emarginate, the lateral lobes very broad, their apices nearly truncate. Dististyle with the lower lobe or style unusually expanded, the width across the blade fully one-half the length ; the entire outer margin of main body of style produced into a broad-based triangle that narrows to the truncated apex, with a further pale obtuse lobe on the outer angle ; style gradually narrowed outwardly, the apex subtruncate and produced into about three strong spinous obtuse blades or points ; outer margin of apical portion of style with a row of powerful setae, those elsewhere on outer third of blade much smaller. Gonapophyses greatly expanded into flattened blades. Aedeagus not clearly developed as a powerful blackened structure, as in *arcuaria* and *triangularis*.

Hab. Peru (Junin).

Holotype, ♂, Tulumay oValley, Tarma, altitude 4000–8000 feet, November 8, 1940 (*Woytkowski*). *Allotopotype*, ♀, November 7, 1940.

The present fly is allied to *Brachypremna arcuaria* Alexander, of Ecuador, and to *B. triangularis* Alexander, of the Maritime Andes, Venezuela, differing very conspicuously in all details of structure of the male hypopygium. The three species form a somewhat isolated group in the genus.

Tipula (Eumicrotipula) agrippina, sp. n.

Belongs to the *glaphyoptera* group; size relatively large (wing, male, 19 mm.); general coloration of thorax yellow pollinose, the præscutal stripes very poorly indicated; antennæ with the flagellar segments beyond the first black; femora yellow, the tips weakly darkened; wings almost uniformly yellow, the prearcular and costal fields, with the stigma, more saturated yellow, the cells beyond cord a trifle more darkened; cell 1st M_2 elongate, its outer end pointed; male hypopygium with the submedian tergal lobes broadly truncate; outer dististyle very long and slender, glabrous except for a few setæ on the distal tenth; inner dististyle with the beak very slender; dorsal crest without modified setæ; eighth sternite with a very long and slender median lobe.

Male.—Length about 16 mm.; wing 19 mm.; antenna about 5.7 mm.

Frontal prolongation of head yellow, including the distinct nasus, the latter tufted with yellow setæ; basal three segments of palpi obscure yellow or brownish yellow; terminal segment relatively short, subequal to the preceding two segments taken together, brownish black, the extreme tip brightened. Antennæ with basal three segments yellow, remainder of flagellum black; flagellar segments moderately incised, the longest verticils shorter than the segments. Head yellow pollinose, the sides of the posterior vertex a little more darkened; vertical tubercle entire but conspicuous and protuberant.

Prothorax light brown, yellow pollinose. Mesonotal præscutum chiefly yellow pollinose, the four olive-brown stripes only slightly differentiated from the interspaces except by faintly darkened borders, the median dark vitta better indicated on the extreme cephalic border; posterior sclerites of notum similarly yellow pollinose; scutellum a little darker. Pleura brownish yellow, dorsopleural membrane clearer yellow; a small depressed brown spot on

cephalic portion of suture between the anepisternum and sternopleurite, immediately behind the fore coxæ. Halteres elongate, yellow, the knobs a trifle more brownish yellow. Legs with the coxæ yellow pollinose, the fore pair a trifle darker; trochanters yellow; femora yellow, the tips rather broadly but weakly darkened; tibiæ and most of proximal two tarsal segments yellow; claws (male) with a small acute tooth. Wings almost uniformly yellow, the disk light yellow, beyond the cord a trifle more brownish yellow; prearcular and costal fields more saturated yellow, cell *C* paler and less intensely brightened; stigma deep yellow; veins yellow. Venation: *Rs* slightly less than twice *m-cu*; *R*₁₊₂ entire; cell 1st *M*₂ elongate, pointed at outer end; *m* oblique, a trifle longer than the petiole of cell *M*₁; *m-cu* just at fork of *M*₃₊₄.

Abdominal tergites extensively darkened, especially the outer segments; basal sternites clear yellow, the outer ones narrowly infuscated at posterior borders; hypopygium chiefly yellow, the eighth sternite darkened. Male hypopygium with the tergite transverse, its caudal border with a very small rounded median notch and very large sublateral ones; sublateral lobes broadly truncated at tips or even gently emarginate, with a very small further lobe at base of median incision; lateral lobes more pointed, especially at the inner apical angle. Ninth sternite with the appendage short and stout, bluntly oval at tip, provided with coarse scattered setæ. Basistyle with lobe of similar shape but a little smaller, more densely provided with long setæ. Outer dististyle unusually long and very slender, provided with setæ only on about the outer tenth. Inner dististyle relatively narrow, the beak very long and slender; lower beak stouter, obtusely rounded, heavily blackened; dorsal crest with long pale scattered unmodified setæ. Gonapophyses and phallosome complex, the phallosome a broadly flattened depressed dark-coloured triangular plate between the apophyses, the margins with numerous small teeth; apophyses conspicuously notched on inner margin to produce three distinct lobes, the terminal one broadly truncate, the subterminal one correspondingly slender. Eighth sternite with the median lobe of unusual length and slenderness, widest just beyond the base, thence narrowed very gradually to the acute tip,

the length about six or seven times the greatest width ; surface covered with very abundant but short pale setæ.

Hab. Ecuador (Bolivar).

Holotype, ♂, Hacienda Talahua, altitude 3100 metres, May 4, 1939 (*Brown*). *Brown* (*Ann. Ent. Soc. America*, xxxiv. p. 848, 1941) has given some further data concerning the station which is on the Pacific slope, the line between the humid temperate forest and the paramo occurring at about 3000 metres.

The two most similar regional species of large size and having almost unpatterned yellow wings are *Tipula* (*Eumicrotipula*) *runtuncnsis* Alexander and *T. (E.) semivulpina* Alexander ; the former has all details of structure of the male hypopygium quite distinct ; the latter is still known only in the female sex but differs evidently in the coloration of the body, the conspicuously bicoloured antennæ, and in the venation, as the small cell 1st M_2 .

Tipula (Eumicrotipula) clavaria, sp. n.

Belongs to the *glaphyoptera* group ; size medium (wing, male, about 15 mm.) ; antennal flagellum beyond the first segment black, the segments strongly incised ; mesonotal præscutum obscure yellow, with brown stripes, including a capillary dark brown median vitta ; posterior sclerites of notum more ashy grey, the scutellum and mediotergite with a capillary dark brown median stripe ; femora yellow, the tips blackened ; wings light brown, only slightly and vaguely patterned with darker brown and subhyaline ; basal abdominal tergites yellow, trivittate with dark brown, the lateral stripes especially distinct, the sub-terminal segments more uniformly blackened ; male hypopygium with the appendage of the ninth sternite a clavate lobe, its knob microscopically setulose ; lobe of eighth sternite small.

Male.—Length about 13.5–14 mm. ; wing 15–15.5 mm. ; antenna about 5–5.5 mm.

Frontal prolongation of head relatively long, about three-fourths as long as remainder of head, light brown ; nasus lacking ; palpi black, the terminal segment unusually short, subequal to the two preceding segments combined. Antennæ moderately long, about one-third the length of

wing; basal segments yellow, first flagellar segment brownish yellow, remainder of flagellum black; segments strongly incised, the outer swelling of the more proximal segments nearly as thick as the basal one; longest verticilla slightly shorter than the segments. Head brownish grey, with a conspicuous dark brown median vitta on the posterior vertex, the sides of the latter more extensively infuscated.

Pronotal scutum protruded dorsally as an oval swelling, obscure yellow, patterned medially and on sides with dark brown; scutellum obscure yellow, darker on sides. Mesonotal præscutum with the ground-colour obscure yellow, with very large brown clouds surrounding the setigerous punctures of the interspaces; intermediate stripes brownish yellow on mesal portion, the outer half slightly darker brown, the stripes divided by a capillary still darker brown vitta; lateral stripes narrow, pale brown lateral borders of præscutum more broadly darker brown; humeral region extensively pale brown, encircling the small deep pseudosutural foveæ; scutum ashy grey, each lobe with two separate dark brown spots; posterior sclerites of notum similarly grey, the scutellum and mediotergite with a narrow brown median line, the latter with scattered brown setigerous punctures elsewhere on surface; cephalic end of the katapleurotergite silvery pubescent. Pleura pale, sparsely pruinose, more heavily so on the anepisternum and dorsal pteropleurite; short longitudinal brown markings on the anepisternum along the ventral portion of the otherwise yellow dorsopleural membrane. Halteres with stem obscure yellow, knob infuscated. Legs with coxæ light brown, grey pruinose, provided with abundant long pale setæ; trochanters yellow, the tips rather broadly blackened, the amount subequal on all legs; tibiæ and basitarsi light brown, the tips darker; remainder of tarsi black; claws (male) simple. Wings with the ground-colour light brown, only vaguely patterned with darker brown and subhyaline; prearcular and costal fields more brownish yellow, cell *Sc* unpatterned; stigma slightly darker than the ground; obliterative band across cell 1st *M*₂ extending to beyond mid-length of cell *M*₂; ante-stigmal and post-stigmal brightenings very restricted to scarcely evident; the broad bases of cells *Ou* to 2nd *A* somewhat paler than the remainder of ground; veins yellowish brown to light

brown. Venation: *Rs* about two and one-half times the long *m-cu*; *R*₁₊₄ entire; petiole of cell *M*₁ nearly twice *m*; *m-cu* on *M*₄ shortly beyond origin, the basal section of the latter distinct; tip of vein *Cu*₁ strongly recurved.

Abdominal tergites yellow, the first more pruinose; a conspicuous brownish black lateral stripe, narrow on the base of tergite two, becoming broader behind, on the third and succeeding segments very wide; a less distinct median stripe, very faint on the more proximal tergites, broader and more intense in colour on outer segments; basal sternites yellow, the fifth and succeeding segments more uniformly blackened; hypopygium chiefly yellow. Male hypopygium with the caudal margin of the tergite conspicuously notched, the median region being produced, with a yellow U-shaped notch on either side, with an even shallower emargination still more laterad; extreme lateral lobes low, microscopically setuliferous. Ninth sternite with the appendage a long-stemmed club, the knob with abundant microscopic setulæ. Basistyle with its lobe reduced to a pencil of a few long bristles. Outer dististyle elongate, very little expanded outwardly. Inner dististyle long and narrow, beak pale; lower beak broadly obtuse, blackened, a small modified anterior crest immediately above the lower beak, pale, with long angularly bent setæ. Gonapophyses bipartite, appearing as a broad flattened outer blade, the tip obtusely rounded, the neck portion more constricted; at base of this blade a second arm, appearing as a long-triangular flange, the margin microscopically spinulose, the slender tip acutely bispinous. Eighth sternite with the lobe relatively small, long-oval, its length about two-and-one-half times the width; surface with long setæ, the longest about equal to the lobe.

Hab. Peru (Junin).

Holotype, ♂, Huasahuasi, Tarma, altitude 2800 metres, April 10, 1940 (*Woytkowski*). *Paratopotype*, ♂, April 18, 1940; *paratypes*, 3 ♂♂, Carpapata, Tarma, altitude 2600 metres, May 4-8, 1940 (*Woytkowski*).

The present fly is readily told from related species, including *Tipula* (*Eumicrotipula*) *inca* Alexander and *T. (E.) thalia*, sp. n., by the structure of the male hypopygium, especially the appendage of the ninth sternite, the inner dististyles and the gonapophyses. The subunicolorous wings present a quite different appearance from

that of *thalia* and other species, but the structure of the hypopygium indicates a close relationship.

Tipula (Eumicrotipula) thalia, sp. n.

Belongs to the *glaphyoptera* group; size medium (wing, male, 13 mm.); mesonotum very obscure yellow, patterned with brown; halteres brownish black, the apex of knob restrictedly brightened; wings light yellow, heavily patterned with dark brown; cells beyond cord checkered brown and yellow, basad of cord with the yellow colour predominating; basal section of vein *M*₁ long, cell 2nd *A* narrow; male hypopygium with the eighth sternite bearing a very long and narrow median rod that is subtended by small fleshy lobules.

Male.—Length about 11 mm.; wing 13 mm.

Head broken.

Pronotum infuscated medially, obscure brownish yellow on sides. Mesonotal præscutum with the pale ground very restricted, the disk with three brown stripes, the median line narrowly darker; posterior interspaces very obscure, the brightest ground becoming more testaceous yellow; scutal lobes chiefly infuscated, the posterior portions of the lobes and the median area very obscure yellow; scutellum brownish testaceous; mediotergite brownish testaceous, sparsely pruinose, the posterior portion paler. Pleura and pleurotergite chiefly yellow, the ventral sternopleurite, meron and bases of the middle and posterior coxæ weakly darkened. Halteres brownish black, the apex of knob restrictedly brightened. Legs with the coxæ, except as described above, brownish testaceous; trochanters yellow; remainder of legs broken. Wings with the ground extensively light yellow, heavily patterned with dark brown; basal portion of prearcular field brown, the outer portion nearer the arculus yellow; cells *C* and *Sc* brownish yellow, patterned with darker; basal area largest, extending from *C* to *Cu* as a major postarcular mark; second and third areas small, not involving cell *C* and extending only half-way across cell *R*, the third at origin of *Rs*; fourth area in outer end of cell *Sc*; stigma dark brown, without trichia; beyond cord, the yellow and brown areas alternate in a checkered pattern, the pale including a large poststigmatal mark; basad of cord, the yellow greatly predominating, including most of cells *R*

to 2nd *A*, the dark colour including areas near outer end of cell *M* and weak clouds in the outer portion of cells *Cu* and 1st *A*; cell 2nd *A* chiefly yellow; cell *Cu*₁ almost uniformly darkened; veins dark brown, a little paler in the costal interspaces. Venation: *Rs* about two-and-one-half times the oblique *m-cu*; *R*₁₊₄ entire; petiole of cell *M*₄ nearly twice *m*; basal section of *M*₄ unusually long, erect, exceeding *r-m* in length; cell 2nd *A* unusually narrow.

Abdomen obscure brownish yellow, variegated with brown, especially on the outer segments, the subterminal segments extensively infuscated; hypopygium paler brown, the eighth sternite with a narrow obscure yellow median line. Male hypopygium with the tergite transverse, its caudal border conspicuously toothed and notched, including two rounded notches on either side of the more produced median area, the latter with two separated carinate teeth that are isolated by a subtruncate median space; lateral notch deeper than the inner one, the extreme outer lateral angle rather narrowly obtuse. Ninth sternite with the appendage pale, short-stemmed, terminating in a large oval knob, the ventral angle of which is slightly produced and bears a pencil of long reddish setæ. Basistyle with the lobe oval, clothed with very short setulæ and with a few coarse setæ. Outer dististyle elongate, slightly expanded at apex. Inner dististyle with the beak slender, reddish brown; lower beak blackened; on face of style back from the beak and extending for about one-half the length of the sclerite a row of blackened setæ forming a crest; just before apex on extreme outer margin with a further concentration of about ten elongate setæ, the pale tips incurved. Gonapophyses appearing as paired flattened blades, each one broad on basal half, thence strongly constricted, at apex expanded into a subcircular plate. Eighth sternite with the caudal border convexly rounded, provided with an unusually long and narrow median rod that is subtended on either side by a very small fleshy lobule bearing several long setæ; median rod a trifle widened outwardly, the length approximately ten times the width, the surface provided with scattered elongate setæ.

Hab. Ecuador (Santiago-Zamora).

Holotype, ♂, Zumbi, Rio Zamora, altitude 700 metres, November 2, 1941 (*Laddey*).

Most similar to species such as *Tipula* (*Eumicrotipula*) *chicana* Alexander, *T. (E.) browniana* Alexander, and

T. (E.) jubilans Alexander, differing from all in the colouration of the body and wings, in the venation, and especially in the structure of the male hypopygium, particularly of the tergite, inner dististyle, gonapophysis and eighth sternite.

Limonia (Dicranomyia) puncaensis, sp. n.

Size relatively large (wing, male, 12 mm.); general coloration of mesonotal præscutum yellow, with three conspicuous dark brown stripes; halteres elongate, stem blackened, the base narrowly yellowed, the apex of knob pale brown; femora with tips yellow; wings whitish subhyaline, with a restricted brown pattern; abdominal tergites conspicuously patterned, the bases and tips narrowly yellow, the broad intermediate portion brownish black; sternites yellow, the lateral borders conspicuously blackened; male hypopygium having the ninth tergite with a V-shaped notch, the lateral lobes obtuse; rostral prolongation small, with two strong spines, the outer one placed at the extreme tip; gonapophyses broad based, each narrowed very gradually to a small pale mesal-apical lobe.

Male.—Length about 9 mm.; wing 12 mm.

Rostrum infuscated; palpi brownish black. Antennæ with scape yellow, pedicel and flagellum brownish black; flagellar segments long-oval to subcylindrical, constricted at the incisures, especially the bases of the segments; verticils shorter than the segments; terminal segment about one-third longer than the penultimate. Head dark brownish grey, clearer grey in front; anterior vertex relatively narrow, about equal in width to the diameter of scape.

Pronotum dark brown, more reddened laterally; pretergites obscure yellow. Mesonotal præscutum with the ground yellow, with three conspicuous dark brown stripes that cover most of the disk, much restricting the interspaces; posterior sclerites of notum dark brown, the posterior margins of the scutal lobes narrowly obscure yellow; central portion of scutum and base of scutellum somewhat more pruinose; posterior border of scutellum obscure yellow; mediotergite infuscated, the cephalic lateral angles light yellow; pleurotergite infuscated, margined with yellow, Pleura chiefly dark brown,

especially on the mesopleura, the propleura and meral region somewhat paler. Halteres elongate, stem blackened, its base narrowly pale yellow, the apex of knob pale brown; stem with a fringe of conspicuous setæ. Legs with coxæ weakly infuscated, especially the fore pair; trochanters yellow; femora obscure yellow, a little darker before the broad pale yellow tips to form a weak subterminal ring; remainder of legs brownish yellow, the outer tarsal segments darker brown. Wings whitish subhyaline, the prearcular and costal fields a little more whitened; a restricted pale brown pattern, including the stigma, together with seams along cord and outer end of cell 1st M_2 ; veins brown. Venation: Sc_1 ending a short distance beyond the origin of R_s , Sc_2 a shorter distance before this origin, Sc_1 alone about one-third R_s ; R_2 elongate, approximately twice the free tip of Sc_2 ; cell 1st M_2 a little longer than vein M_4 beyond it; $m-cu$ just before the fork of M .

Abdominal tergites conspicuously patterned with dark brown and bright yellow, the latter including subequal bases and tips of all the segments, leaving the broad intermediate section brownish black, the central portion a little paler than the outer margins; sternites clear light yellow, with conspicuous black lateral borders; eighth segment pale; hypopygium brownish yellow, the tips of the ventral dististyles paler. Male hypopygium with the caudal border of tergite conspicuously emarginate, the lobes not modified, obtuse. Basistyle relatively small, the ventromesal lobe simple, with long conspicuous setæ. Dorsal dististyle an unusually small and weak rod, chiefly pale, widened before mid-length, thence narrowed to the slightly decurved acute tip. Ventral dististyle large and fleshy, its area about four times that of the basistyle; rostral prolongation small, its ventral margin sloping upward to the outer spine, without a projection beyond this point; face of projection with a row of four powerful spinous setæ down the face; spines slightly unequal, the outer one a little longer, separated by a short space. Gonapophysis broad-based, narrowed very gradually into the unusually small pale mesal-apical lobe. Prootiger appearing as a broad pale membrane, with abundant setoid extensions except near the margin. *Ædeagus* with numerous strong setæ on about the basal half.

Hab. Peru (Pruno).

Holotype, ♂, Puno, altitude 12,500 feet, May 6, 1938 (J. Adger Smyth).

From other high Andean members of the subgenus, including *Limonia* (*Dicranomyia*) *andicola* (Alexander) and *L. (D.) titicacana* Alexander, the present fly differs conspicuously in the details of coloration of the thorax and abdomen, and, especially, in the structure of the male hypopygium.

Limonia (*Rhipidia*) *multipunctigera*, sp. n.

Size medium (wing, female, 7.5 mm.); general coloration of thoracic dorsum brownish grey, patterned with darker brown, including three narrow discal vittæ; antennæ black, the first flagellar segment obscure yellow, the stems of the succeeding segments yellow; flagellar segments (female) simply produced; knobs of halteres darkened; coxæ black, the tips pale; femora pale brown, the extreme tips vaguely paler; tibiæ brownish yellow; wings pale yellow, abundantly dotted with pale brown, together with a few larger darker areas; Sc_1 ending about opposite three-fifths R_s ; cell 1st M_2 about equal in length to the distal section of M_{1+2} ; $m-cu$ shortly before the fork of M .

Female.—Length about 7 mm.; wing 7.5 mm.

Rostrum and palpi black. Antennæ broken beyond the sixth segment; scape brown above, yellow beneath; pedicel brownish black; flagellum black, the first segment much paler, obscure yellow; stems of the succeeding segments yellow, contrasting with the blackened bases; basal four flagellar segments appearing as flattened-globular enlargements, the lower face more produced than the upper but not branched; longest verticils black, about one-half longer than the segments. Head dark greyish brown; anterior vertex relatively narrow.

Pronotum dark brown, sparsely pruinose, clearer grey above. Mesonotal præscutum brownish grey, patterned with darker brown, including three narrow vittæ crowded on the median third, these becoming more confluent and suffused on the posterior half; scutal lobes patterned with darker brown; scutellum and mediotergite dark brown, grey pruinose. Pleura and pleurotergite chiefly dark brown, the latter slightly more pruinose; ventral sternopleurite slightly paler. Halteres with stem obscure

yellow, knob darkened. Legs with the coxæ darkened on about the proximal half, the tips pale; trochanters obscure yellow; of the remainder of legs a single partial hind leg remains; femora pale brown, its extreme tip vaguely paler; tibiæ still paler brownish yellow; tarsi broken. Wings with the restricted ground pale yellow, much less extensive than the dark pattern, which appears chiefly as a multitude of pale brown dots in all the cells, these chiefly confluent or tending to fuse; a sparse darker brown pattern, consisting of slightly larger areas at arculus, at near mid-length of *Sc*, origin of *Rs*, fork of *Sc*, stigma, cord and outer end of cell 1st M_2 ; veins obscure yellow or brownish yellow, still darker in the patterned areas. Venation: *Sc* long, Sc_1 ending about opposite three-fifths *Rs*, Sc_2 near its tip; *Rs* angulated at origin; cell 1st M_2 relatively long and narrowly rectangular, about equal in length to the distal section of M_{1+2} ; *m-cu* shortly before the fork of *M*; vein 2nd *A* rather strongly sinuous.

Abdominal tergites brown, the lateral and caudal borders of the segments more darkened, to produce a bicoloured appearance: sternites more testaceous yellow, the posterior margins somewhat darker. Ovipositor with the cerci reddish horn-colour, slender, the tips acute.

Hab. Ecuador (Santiago-Zamora).

Holotype, ♀, Zumbi, Rio Zamora, altitude 700 metres, November 1, 1941 (*Laddey*).

The only regional species having a somewhat similar wing-pattern is *Limonia* (*Rhipidia*) *myriasticta* Alexander, which is an entirely different fly, having the antennæ, even in the female sex, with the flagellar segments bipectinate.

Limonia (*Geranomyia*) *subvirescens clementis*, subsp. n.

Male.—Length, excluding rostrum, about 4.5 mm.; wing 5 mm.; rostrum about 2.6 mm.

Characters as in the typical form, *subvirescens* Alexander, of Cuba, and the subspecies *jamaicæ* Alexander, of Jamaica, differing especially in the details of structure of the male hypopygium.

Venation: *m-cu* about one-third its length before the fork of *M*. Male hypopygium with the apex of the rostral prolongation of the ventral dististyle relatively stout but not obtuse, as in the typical subspecies, slightly pointed at tip; spines about one-third longer than the length of the

prolongation distad of their insertion. Mesal-apical lobe of gonapophysis long and slender, gradually narrowed to the acute tip, before the apex with a strong constriction; margin of lobe smooth, without denticles.

Hab. Peru (Junin).

Holotype, ♂, Satipo, Jauja, altitude 800–900 metres, April 8, 1941 (*Paprzycki*).

Helius (Helius) plebeius, sp. n.

Thoracic dorsum chiefly black, the præscutum more obscure yellow, with three black stripes; pleura and pleurotergite black; legs yellow, the femoral tips blackened; wings yellow, the prearcular and costal fields clear light yellow; a restricted dark brown wing-pattern; abdominal tergites blackened, with a transverse yellow ring before the narrowly blackened posterior border; sternites yellow, with an elongate black area on either side.

Female.—Length about 8 mm.; wing 6.1 mm.; rostrum alone about 0.6 mm.

Rostrum black, relatively short, as shown by the measurements. Antennæ black throughout; basal flagellar segments short and crowded, the second transverse; outer segments passing through oval to elongate-oval, the terminal one very long, about one-third longer than the penultimate. Head dark.

Cervical region black. Pronotum black medially, more reddish brown on sides. Mesonotal præscutum with the ground-colour reddish brown, sparsely pruinose, with three conspicuous black stripes, the median one not reaching the suture behind; humeral and lateral portions of the præscutum broadly reddened; scutum with lobes blackened, the median region paler; posterior sclerites of notum black. Pleura black, a little paler on the dorsopleural region and immediately beneath this. Halteres yellow. Legs with the coxæ reddish yellow; trochanters yellow; femora obscure yellow, the tips gradually blackened, relatively broad; remainder of legs obscure brownish yellow, the outer tarsal segments slightly darker. Wings with a yellowish ground, the prearcular and costal fields clear light yellow; distal ends of outer radial cells more strongly infuscated; a conspicuous dark brown pattern, including the elongate stigma and spots at origin of R_2 , tip of R_3 , anterior cord, and more narrowly over the posterior

cord and outer end of cell 1st M_2 ; a longitudinal brown wash at near mid-length of basal section of vein Cu , involving the membrane on both sides; small dusky marginal clouds at ends of veins M_4 to 2nd A , inclusive; veins yellow, brown in the heavily-patterned areas, clear light yellow in the brightened fields. Venation: Rs arcuated at origin, about one-half longer than the arcuated basal section of M_{1+2} ; anterior branch of Rs strongly upcurved at tip so cell R_2 is only about one-fifth as extensive at margin as is cell R_3 ; cell 1st M_2 elongate, only a little less than vein M_{1+2} beyond it; $m-cu$ a short distance before the fork of M ; distal section of Cu_1 long, fully three times $m-cu$.

Abdomen brownish black, the more basal tergites at and beyond mid-length conspicuously ringed with yellow, the basal rings and narrow posterior borders dark brown; sternites polished yellow, each segment with a brownish-black area on either side; subterminal sternites narrowly blackened; ovipositor with genital shield yellow castaneous; cerci elongate, very slender, upcurved to the acute tips.

Hab. Ecuador (Santiago-Zamora).

Holotype, ♀, Zamora, altitude 1000 metres, October 19, 1941 (*Laddey*).

Most closely related to *Helius* (*Helius*) *fragosus* Alexander, of south-eastern Brazil, from which it differs in details of coloration of the legs and wings and in slight details of venation. The somewhat peculiar abdominal pattern is almost exactly as in *fragosus*.

Orimarga (*Diotrepha*) *profusus*, sp. n.

Size relatively large (wing, male, 6 mm.); general coloration of thorax uniformly brown, unpatterned, with a sparse pruinosity; legs white, the femoral tips broadly blackened, of the tibiæ more narrowly so; wings with a smoky tinge, the costal border more yellowed; certain of the veins, especially Cu , seamed with darker; vein R_1 merging gradually with vein R_2 , with no trace of R_{1+2} ; male hypopygium with the ventromesal lobe of basistyle large and conspicuous; inner dististyle with long black setæ, especially at and near apex; phallosome projecting caudad as a median blackened structure.

Male.—Length about 10 mm.; wing 6 mm.

Rostrum and palpi black. Antennæ black throughout. Head light brownish grey, the narrow anterior vertex light grey.

Pronotum brownish black. Mesonotum almost uniformly brown, unpatterned, with a very sparse pruinosity. Pleura brown, with a more blackish longitudinal stripe, extending from above the fore coxæ to the base of the abdomen, passing beneath the root of the halteres. Halteres with stem dusky, yellow at base, knob blackened. Legs with coxæ testaceous brown to pale brown; trochanters yellow; femora very pale yellow, the tips broadly blackened; tibiæ white, the bases very narrowly infuscated, the tip similarly blackened; tarsi white. Wings with a smoky tinge, the costal border more yellowed; several of the veins further bordered by slightly darker brown, most evident over the entire length of vein *Cu* and again near the wing-tip at end of vein R_3 ; veins very pale brown, more brownish yellow in the brightened costal field. Venation: Sc_1 ending about opposite two-fifths the length of Rs , the latter angulated at origin; vein R_1 merging gradually with vein R_2 , with no trace of R_{1+2} ; R_2 in virtual transverse alignment with $r-m$; basal section of R_{4+5} long, arcuated at origin; $m-cu$ just before one-third the length of vein M .

Abdominal tergites brownish black, the sternites a trifle paler; hypopygium chiefly dark brown. Male hypopygium large and conspicuous, the various parts more developed than in *atribasis*. Tergite produced medially, without elongate setæ. Basistyle with the ventromesal lobe large and conspicuous, the outer apical angle further produced, the entire apex with numerous stout setæ; at base of this major lobe with a further small setiferous lobule; apex of basistyle on mesal face with two very long and powerful setæ. Dististyles blackened, united basally, the outer style a little longer, the acute tip straight; lower margin and apex of the inner style with abundant and very conspicuous darkened setæ. Phallosome projecting conspicuously caudad as a median blackened structure, the outer apical angles a trifle divergent; gonapophyses with acute spines; a small oval lobe on either side of phallosome at base with about five unusually long setæ.

Hab. Peru (Ayaacucho).

Holotype, ♂, Ayna, La Mar, altitude 2400 metres, April 26, 1941 (*Woytkowski*).

Orimarga (Diotrepha) profusa is most similar to *O. (D.) atribasis* Alexander, wide-spread at low altitudes over northern South America. The two flies differ especially in the structure of the male hypopygia, including the tergite, basistyles, dististyles and phallosome.

Epiphragma (Epiphragma) cynotis, sp. n.

* Size above medium (wing, male, 13 mm.); mesonotal præscutum with the humeral and lateral portions chestnut-brown, the disk occupied by four confluent brownish-yellow stripes; head in front deep fulvous, the posterior vertex brownish grey; dorsal thoracic pleurites darkened; knobs of halteres extensively pale; legs yellow, the femora with two broad blackened rings; wings yellow, with a medium brown pattern that is partly ocelliform; cell 2nd A with about six or seven darkened areas all broadly connected along the margin; male hypopygium with the outer dististyle very small, nearly glabrous, only about one-third the size of the very conspicuous inner dististyle, the latter expanded on basal half.

Male.—Length about 11.5 mm.; wing 13 mm.; antenna about 3.2 mm.

Rostrum obscure yellowish brown; palpi black. Antennæ black, the fusion-segment abruptly light yellow; fusion-segment comprised of two segments, the suture partly indicated; outer flagellar segments subcylindrical, about as long as the verticils; segments with further dense but very short setulæ. Head above on anterior vertex deep fulvous, the occiput brown, sparsely pruinose, the broad intervening area of the posterior vertex brownish grey in front, narrowly bordered by dark brown, this colour continued onto the orbits.

Pronotum brown, brownish black on the sides. Mesonotal præscutum with the humeral and lateral portions chestnut-brown, the disk occupied by four confluent brownish-yellow stripes, the cephalic third of the sclerite with a more blackened capillary vitta; scutal lobes medium brown, more yellowed behind; posterior sclerites of notum more greyish pruinose; scutellum with indications of a capillary darkened median vitta, parascutella yellow; mediotergite conspicuously yellowed on posterior third, the anterior portion brown, sparsely pruinose; pleurotergite infuscated, more yellowed on the ventral and dorsal

borders. Pleura above chiefly darkened, the ventral sclerites more yellowed, including most of the sternopleurite; meron and metapleura more pruinose; dorso-pleural membrane dusky. Halteres elongate, stem weakly darkened, its base narrowly yellow; knob slightly darkened, the tip broadly pale. Legs with the coxæ yellow, more or less darkened basally, more extensively so on the fore pair; trochanters obscure yellow; femora obscure yellow, with two broad blackened rings, the outer subterminal one somewhat darker, about three times the yellow apex and slightly exceeding the subterminal yellow ring; remainder of legs yellow, the tips of the tibiæ a trifle darkened. Wings yellow, with a medium brown pattern that is partly ocelliform, the areas centreing at arculus, origin of *Rs*, cord, outer end of cell 1st M_2 , R_3 and fork of M_{1+2} ; dark area at arculus almost solid; all darkened areas medium brown, without darker borders; a series of about six or seven dark areas in cell 2nd *A*, these all broadly interconnected along the border; cell 1st *A* with about four such areas, including those at the veins; cell *Cu* with a group of four spots at near mid-length; veins brownish yellow, darker in the more heavily-patterned areas, yellow in the costal interspaces. Venation: Sc_2 ending nearly opposite the fork of R_{2+3+4} , Sc_1 shorter; supernumerary cross-vein in cell *C* oblique; *Rs* long, square and spurred at origin; R_{2+3+4} about one-third longer than *m-cu*, the latter less than its own length beyond the fork of *M*.

First abdominal tergite greyish pruinose, succeeding tergites medium brown, narrowly darker laterally; sternites yellow, darker laterally, most extensively so at base of second segment; outer segments more extensively darkened; hypopygium brownish yellow. Male hypopygium with the tergal lobes conspicuous, separated by a notch having nearly the same outline. Interbase with the apex recurved into an acute spine. Dististyles distinctive, the outer style very small, nearly glabrous, its long slender tip acute; inner style very large, its area fully three times that of the outer which it completely covers; broadest across the basal half, the outer angle of which is produced into a shoulder that is provided with about a dozen long conspicuous setæ; inner portion of the expanded base with fewer long delicate pale setæ; outer half of style gradually

narrowed, the tip obtuse, with four strong curved yellow setæ.

Hab. Peru (Ayacucho).

Holotype, ♂, Yanamonte, La Mar, in fog forests, altitude 3000–4100 metres, October 5, 1941 (*Woytkowski*).

The most similar described species is *Epiphragma* (*Epiphragma*) *felix* Alexander, from this same general locality. This latter has the wing-pattern somewhat the same though differing in all details, while the body and legs are quite differently patterned. The structure of the male hypopygium of the present fly is distinct from that of the now numerous species known from Tropical America.

Epiphragma (*Epiphragma*) *claudia*, sp. n.

Size large (wing, female, over 16 mm.); general colouration of mesonotum yellowish grey, patterned with brown; antennæ with the fusion-segment clear light yellow, the succeeding segments obscure yellow, the outer ones passing into brown; apices of the knobs of halteres whitened; legs medium brown, only the femoral bases more yellowed; wings whitish subhyaline, with an unusually clear-cut light brown pattern; all dark areas narrowly bordered by darker brown; cell *2nd A* with three dark areas, cell *1st A* with two; abdominal tergites obscure yellow, the basal rings patterned with dark brown, especially distinct on the lateral borders; sternites light yellow.

Female.—Length about 16 mm.; wing 16.5 mm.; antenna about 4.2 mm.

Rostrum golden yellow; palpi brown. Antennæ relatively long; scape and pedicel dark brown; fusion-segment clear light yellow, succeeding segments obscure yellow, the outer ones passing into brown; fusion-segment completely involving two segments. Head above deep brown; anterior vertex and orbits more yellowed.

Pronotum dark brown medially, more yellowed on sides. Mesonotal præscutum and scutum with the ground-colour yellowish grey, patterned with brown; præscutal stripes pale brown, their posterior ends much darker to appear as four oval brown dashes; scutal lobes with posterior portions marked with brown, the median area even more extensively darkened; scutellum and postnotum light grey, parascutella dark brown; lateral borders of mediotergite and most of pleurotergite dark brown, the

katapleurotergite silvery pruinose. Pleura silvery grey, conspicuously variegated with dark brown spots, most extensively so on the ventral sternopleurite. Halteres with stem yellow, base of knob infuscated, its apex yellowish white. Legs with the outer faces of coxae yellowish grey, restrictedly spotted with brown; trochanters obscure yellow; remainder of legs medium brown, the femoral bases rather narrowly more yellowed. Wings whitish subhyaline, with an unusually clear-cut light brown pattern, all areas clearly delimited by narrow dark brown borders; dark areas tending to be separated or merely contiguous; in cell 2nd *A* only three dark areas, including the one at end of vein; cell 1st *A* with two areas, both at the ends of the veins; cell *Cu* with about five major markings; dark seam over the supernumerary cross-vein in cell *C* confluent with the outer margin of the dark area ceptreing at origin of *Rs*; veins yellow, dark brown in the patterned areas. Venation: Supernumerary cross-vein about opposite one-third to one-fourth *Rs*, the latter angulated at origin, its basal section oblique; R_{2+3+4} relatively short, subequal to or less than R_{2+3} ; cell 1st M_2 widened outwardly; *m-cu* less than its own length beyond the fork of *M*.

Abdominal tergites obscure yellow, the basal rings patterned with dark brown, especially distinct on the lateral portions, less evidently darkened on the median portion of the posterior rings, the extreme posterior margins light grey pruinose; sternites light yellow, the terminal segments more infuscated.

Hab. Peru (Ayacucho).

Holotype, ♀, Yanamonte, La Mar, in fog forests, altitude 3000-4100 metres, October 6, 1941 (*Woytkowski*).

Epiphragma (*Epiphragma*) *claudia* is well-distinguished from the other regional species having a somewhat similar wing-pattern and unvariegated legs by the large size and distinctly darkened borders on all the markings of the wings. Such other species include the various forms that are allied to *E. (E.) solatrix* (Osten Saeken), especially *E. (E.) imitans* Alexander, a much smaller fly with distinctive wing-pattern and details of venation.

Shannonomyia cereberana, sp. n.

General coloration of mesonotum brownish black, the sides of the pleura chiefly obscure yellow; head brownish

black, the centre of the anterior vertex with an impressed line; halteres relatively long, the knobs unusually large and flattened; wings with a strong blackish tinge; sparse macrotrichia in outer ends of cells R_3 to 2nd M_2 , inclusive; cell M_1 open by the atrophy of basal section of M_3 ; cell 2nd M_2 about one-half longer than its petiole; $m-cu$ its own length beyond the fork of M ; male hypopygium with the outer dististyle unequally bifid at apex, the outer spine long and curved; mesal face of basistyle produced into an oval flattened blade, with a further curved hook near its base; gonapophyses very small pale blades, oval in outline.

Male.—Length about 5.5 mm.; wing 5.8 mm.

Rostrum short, brownish black; palp black. Antennæ with scape and pedicel brownish black; flagellum broken. Head brownish black, sparsely pollinose to produce an opaque appearance; centre of anterior vertex with a blackened sunken linear impression; anterior vertex relatively broad, about four times the diameter of scape.

Pronotum dark brown, the scutellum more brownish yellow. Mesonotum chiefly brownish black, the surface subnitidous; posterior sclerites of notum more piceous to reddened, the postnotum obscure brownish yellow, more or less pruinose. Pleura chiefly obscure yellow, contrasting with the blackened dorsum; propleura, ventral sternopleurite and lower portion of anepisternum slightly more darkened; meron more pruinose; dorsopleural membrane infuscated. Halteres relatively long, with the knobs unusually large and flattened; stem light brown, knob blackened. Legs with the coxæ obscure yellow, relatively long; trochanters obscure yellow; remainder of legs broken. Wings with an unusually strong blackish tinge, the stigmal region undifferentiated except for a barely indicated pale ring; veins brown. Sparse macrotrichia in outer ends of cells R_3 to 2nd M_2 , inclusive, arranged in a narrow row down the centres of the cells. Venation: Sc_1 ending about opposite four-fifths the length of R_3 , Sc_2 very close to the extreme tip, exceeding Sc_1 in length; R_3 relatively long, exceeding in length its anterior branch; R_4 faintly indicated, at near mid-length of stigma, shorter than R_{1+2} ; elements of anterior cord in transverse alignment, $r-m$ arcuated; cell M_1 open by the atrophy of basal section of M_3 , cell 2nd M_2 about one-half longer than

its petiole ; *m-cu* its own length beyond the fork of *M* and only a little shorter than the distal section of *Cu*₁.

Abdomen black, the more proximal sternites paler. Male hypopygium with the caudal margin of tergite broadly emarginate, the lateral lobes produced into small obtuse points. Mesal face of basistyle at cephalic end produced into a recurved blackened point, this latter possibly an interbase. Outer dististyle blackened, relatively slender, unequally bifid at apex, the outer spine long and curved ; surface of style with scattered elongate setæ. Inner dististyle relatively small, dark-coloured. Gonapophyses very small, appearing as long oval pale blades. *Ædeagus* relatively long, the penis spiraloid on basal two-thirds.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Rio Blanco, near Baños, altitude 2000 metres, May 14, 1937 (*Macintyre*).

The reference of this distinct fly to *Shannonomyia* Alexander must be held as being somewhat provisional, since it deviates from the characters of the genus in certain respects of venation and structure of the male hypopygium. The cell *M*₂, open by the atrophy of the basal section of vein *M*₃, provides an almost unique character in the genus, elsewhere being known only in the Mexican *Shannonomyia lenitatis* Alexander, which lacks macrotrichia in the cells of the wings.

Hexatoma (Eriocera) captiosa, sp. n.

General coloration of thorax and abdomen dark brown or brownish black, the posterior sclerites of the mesonotum and the pleura sparsely pruinose ; legs brown or testaceous brown ; wings brownish grey, the prearcular and costal borders narrowly darker, stigma not differentiated ; macrotrichia of veins beyond cord very sparse ; abdomen, including hypopygium, brownish black.

Male.—Length about 8.5 mm. ; wing 9.5 mm. ; antenna about 2.1 mm. .

Rostrum short, dark brown ; palpi brownish black. Antennæ relatively short, seven-segmented, brown, the outer flagellar segments a trifle paler ; first flagellar segment a little longer than segments two and three combined ; flagellar segment four longer than either three or five, the two latter subequal in length. Head above dark liver-brown, the vertical tubercle dull orange-

red; vertical tubercle relatively high, deeply impressed medially.

Pronotum dark brown. Thorax relatively dark brown, the disk of the præscutum of the unique type chiefly destroyed; scutellum and median region of scutum light grey pruinose, the mediotergite less evidently so. Pleura and pleurotergite dark brown, the entire surface sparsely grey pruinose. Halteres with stem dark brown, its outer portion, with the knob, broken. Legs with coxæ dark brown, sparsely pruinose; remainder of legs brown or testaceous brown, the terminal tarsal segment darker; claws (male) with a long basal tooth. Wings with a brownish-grey suffusion, the prearcular and costal regions narrowly darker; stigma not differentiated from the ground; radial branches narrowly and vaguely seamed with brown; veins brown, those of the outer medial field more delicate and paler. Veins unusually glabrous, beyond the cord and excluding R_1 with five or six very scattered trichia on distal half of outer section of vein R_5 . Venation: Sc_1 ending shortly beyond level of $r-m$, Sc_2 a comparable distance before this cross-vein; R_{2+3} a little exceeding R_2 and about one-half as long as R_{1+2} ; cell 1st M_2 a trifle less than vein M_4 ; $m-cu$ about one-third to one-fourth its length beyond the fork of M , subequal to the distal section of Cu_1 ; cell 2nd A narrower than in *peruviana*.

Abdomen dark brown to brownish black, including the hypopygium, the basal segments a very little paler.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂. Abitagua, altitude 1100 metres, April 13, 1940 (*Macintyre*).

This fly is most similar to *Hexatoma* (*Eriocera*) *peruviana* Alexander of southern Peru, differing especially in the different coloration of the body, particularly of the thorax and abdomen. Both species have the unusually sparse macrotrichia of the veins beyond the cord. The fly also superficially resembles *H. (E.) perenensis* (Alexander), likewise from Peru, which has abundant macrotrichia on the outer radial veins.

Hexatoma (*Eriocera*) *aglaia*, sp. n.

Size relatively small (wing, male, 9 mm.); general coloration of mesonotum dark brown, the humeral region

of præscutum obscure yellow, pleura and pleurotergite heavily grey pruinose; knobs of halteres darkened; femora yellow, with two dark brown annuli, the outermost terminal in position; wings with three yellow cross-bands, alternating with three pale brown bands, the basal band being yellow, the apical one brown; abdomen with basal four segments yellow, succeeding three black, apical two segments orange.

Male.—Length about 10 mm.; wing 9 mm., antenna about 2.3 mm.

Rostrum light brown; palpi and mouth-parts darker brown. Antennæ short, broken at end of the sixth segment (length to here 2.1 mm.), scape orange, pedicel and first flagellar segment testaceous yellow, succeeding segments passing into light brown; first flagellar segment only a little shorter than the succeeding three taken together. Head fiery orange, somewhat more infuscated on sides of posterior vertex, more pruinose on the genæ; vertex tubercle consisting of two oval lobes or knobs behind the antennal fossæ.

Pronotum dark brown, heavily grey pruinose. Mesonotal præscutum with the restricted ground obscure yellow, virtually confined to the humeral triangles, the remainder dark brown to form a discal shield: posterior sclerites of notum similarly dark brown, the scutellum more pruinose. Pleura and pleurotergite dark brown even more heavily pruinose. Halteres with knob dark brown. Legs with the coxæ dark brown, grey pruinose; trochanters obscure yellow, basally, more infuscated at tips; femora obscure yellow, with two dark brown annuli, one post-medial, the second terminal, enclosing a somewhat broader, clearer yellow annulus; tibiæ and tarsi pale brown to yellowish brown, the terminal tarsal segments brownish black. Wings light yellow, with three pale brown cross-bands that alternate with three comparable bands of the ground, the latter prearcular, at one-third the wing-length, the third band at and immediately before cord; the dark bands lie beyond the arculus, at mid-length of wing and the very broad apex, the latter involving the outer half of the 1st M_2 ; the margins of all bands, especially of outer half of wing, unusually straight and parallel-sided; veins pale brown, light yellow in the ground areas. Veins with sparse trichia; beyond the cord with a restricted series on

distal section of vein R_2 . Venation: R_2 at fork of R_{2+3+4} , R_{2+4} lacking or punctiform; cell 1st M_2 with its inner end oblique, lying more proximad than the other elements of cord; $m-cu$ at fork of M , about one-third longer than the distal section of Cu_1 .

Abdomen with basal four segments light yellow, only the first tergite restrictedly infuscated on posterior portion; segments five to seven, inclusive, black, forming a subterminal ring, segments eight and nine orange; surface of segments nitidous or subnitidous, without differentiated rings.

Hab. Ecuador (Napo-Pastaza).

Holotype, ♂, Abitagua, altitude 1100 metres, April 13, 1940 (*Macintyre*).

The present fly suggests species such as *Hexatoma* (*Eriocera*) *magistra* Alexander and *H. (E.) plaumanni* Alexander, differing conspicuously in all details of coloration of the body and wings, and in the venation.

Elephantomyia (Elephantomyia) pictiventris, sp. n.

Size medium (wing, female, 7.8 mm.); rostrum longer than the wing; mesonotal præscutum yellow, the ground almost obliterated by three dark stripes; posterior sclerites of notum extensively dark brown, variegated by yellow; pleura yellow, with a brownish-black transverse girdle involving the mesepisternum and mid-coxæ; legs yellow, the femoral tips narrowly blackened; tibial spurs lacking; wings brownish yellow, heavily patterned with medium brown, this appearing as broad seams to many of the veins; stigma oval, dark brown and very conspicuous, preceded and followed by more yellowed areas; branches of R_s extending generally parallel to one another for their entire length; abdominal sternites very conspicuously and handsomely patterned, the borders narrowly black, the central area occupied by a black triangle, restricting large polished yellow marks on either side.

Female.—Length, excluding rostrum, about 9 mm.; wing 7.8 mm.; rostrum about 8.5 mm.

Rostrum elongate, exceeding the wing in length, medium brown, darker at tip; palpi brown. Antennæ 15-segmented, brown throughout; flagellar segments elongate subcylindrical, the verticils much exceeding the segments in length. Head above light grey; anterior vertex

reduced to a narrow strip that is only a little more than one-half the diameter of the scape.

Pronotum dark brown above, paler on sides. Mesonotal præscutum with the ground-colour obscure yellow, with three stripes, the median one dark brown, slightly widened behind but not quite reaching the suture, further divided for most of its extent by a capillary median black vitta; lateral stripes more reddish brown; posterior sclerites of notum extensively dark brown, variegated by yellow on the lateral borders and posterior angles of the scutal lobes, the parascutella, lateral margins of mediotergite and all of pleurotergite. Pleura yellow with a brownish-black transverse girdle involving the entire mesepisternum and middle coxæ but not crossing the dorsopleural field. Halteres with stem pale, knob dark brown. Legs with the coxæ yellow, excepting the blackened middle coxæ; trochanters yellow; femora obscure yellow, the tips narrowly but conspicuously black, the amount subequal on all legs, preceded by a wider, somewhat clearer yellow ring; tibiæ and tarsi obscure yellow; tibial spurs lacking. Wings brownish yellow, heavily patterned with medium brown, this appearing as a costal border, involving cells *C* and *Sc*, and as broad seams to various veins, including *Rs*, cord, outer end of cell 1st *M*₂ and vein *Cu*; narrower seams over most of the remaining veins, especially 2nd *A*; wing-tip in outer radial field strongly darkened; stigma oval, dark brown, very conspicuous, preceded and followed by more yellowish areas; veins brown. Venation: *Sc*₁ ending just before the fork of *Rs*, *Sc*₁ somewhat longer than *Sc*₂, placed near its tip; branches of *Rs* extending generally parallel to one another for virtually their entire length, the anterior branch beneath the stigma very gently sinuous; cell 1st *M*₂ about as long as distal section of vein *M*₃; *m-cu* about its own length beyond the fork of *M*, one-fifth longer than the distal section of *Cu*₁; cell 2nd *A* moderately wide.

Abdominal tergites chiefly dark brown, only the lateral borders conspicuously yellow, the amount slightly increased at near mid-length of segment thereby constricting the broad brown central stripe; sternites very conspicuously patterned, each being narrowly bordered on sides and across posterior margin with black and with a broad black central triangle, its point directed cephalad, the broad base

being confluent with the posterior border, thus restricting broad polished yellow sublateral areas on each segment; the central dark triangle is best defined on the more basal segments, on the fifth and sixth becoming narrower, on the subterminal sternites lacking or indicated only by a reddish tinge, the black borders remaining clear and distinct. Ovipositor with the genital shield yellow; cerci elongate, reddish horn-colour, slender, upcurved at tips; hypovalvæ horn-yellow, blackened at bases.

Hab. Ecuador (Santiago-Zamora).

Holotype, ♀, Zamora, altitude 1000 metres, October 19, 1941 (*Laddey*).

The present fly is readily told from the other described regional forms by the heavily-patterned wings and by the coloration of the body, particularly the mesonotum and the abdominal sternites. It is most similar to species such as *Elephantomyia* (*Elephantomyia*) *angustissima* Alexander, yet is amply distinct.

Gonomyia (*Lipophleps*) *subscimitar*, sp. n.

Belongs to the *manca* group, allied to *scimitar*; size small (wing, male, about 3 mm.); mesonotum chiefly cinnamon-brown, thoracic pleura conspicuously striped with yellow and brown; legs brown; wings with a strong brownish-grey suffusion, the prearcular and costal fields light yellow; male hypopygium with the apical lobe of basistyle slender, narrowed outwardly, the setæ short; outer dististyles of the two sides symmetrical, each appearing as a strongly-curved hook; phallosome with the paired elements entirely pale, feebly sclerotized, their tips obtusely rounded.

Male.—Length about 2.7–2.8 mm.; wing 3 mm.

Rostrum and palpi black. Antennæ with the scape bicoloured, yellow above, infuscated beneath; pedicel yellow, flagellum brownish black; verticils of male very elongate. Head light yellow, the centre of vertex more darkened.

Pronotum and pretergites pale yellow. Mesonotum chiefly cinnamon-brown, centre of scutum obscure yellow; scutellum obscure yellow, narrowly more darkened medially; mediotergite chiefly pale yellow, the cephalic portion more darkened. Pleura and pleurotergite striped with pale yellow and brown, the former including a

conspicuous longitudinal stripe that is bordered both above and below by narrower brown lines, more deeply coloured immediately adjoining the yellow band, thence becoming gradually paler. Halteres with stem yellow, knob weakly darkened. Legs with coxæ and trochanters yellow; remainder of legs brown, the outer segments darker. Wings with a rather strong brownish-grey tinge; prearcular and costal fields light yellow, stigmal region a trifle more darkened; veins pale brown, more yellowed in the brightened fields. Venation: Sc_1 ending just before origin of R_s ; anterior branch of R_s strongly upcurved at outer end; cell 1st M_2 closed; $m-cu$ at or very close to fork of M .

Abdomen yellow, the lateral and caudal portions of the outer segments more narrowly infuscated to produce a weakly-banded appearance; hypopygium orange. Male hypopygium with the apical lobe of basistyle about one-half as long as the remainder of style, strongly narrowed outwardly, the apex narrowly obtuse, the setæ relatively short. Outer dististyle a strongly curved sclerotized hook, symmetrical on the two sides; inner dististyle with a single enlarged seta, the others normal. Phallosome with the paired blades entirely pale and only feebly sclerotized, their tips obtusely rounded.

Hab. Peru (Junin).

Holotype, ♂, Satipo, Jauja, altitude 800–900 metres, April 8, 1941 (*Paprzycki*). *Paratopotypes*, 7 ♂♂, November 28, 1940 to April 5, 1941 (*Paprzycki*).

The nearest described relative of the present fly is *Gonomyia* (*Lipophleps*) *scimitar* Alexander, of British Guiana, which differs in all details of the male hypopygium, including the stouter lobe of the basistyle with the tip obtuse and with much longer setæ, the narrow blackened paired blades of the phallosome, and other characters. The strongly-curved outer dististyles are of about the same length and stoutness as in *scimitar*, being much larger than in species such as *G. (L.) puer* Alexander but smaller and stouter than in *G. (L.) producta* Alexander and certain other related forms.

Erioptera (*Mesocyphona*) *iquitosensis*, sp. n.

Allied to *bicinctipes*; thoracic pleura with a conspicuous silvery longitudinal stripe; legs yellow, the posterior femora with two dark rings; wings unpatterned; male

hypopygium with the dististyle three-branched, the longer axial arm forking at near two-thirds the length into two branches, the shorter one with a comb of short blackened teeth, the longer outer branch a sinuous acute spine; third branch arising at extreme base of style; gonapophysis single on either side, appearing as a strong curved horn that narrows to the acute tip, its outer surface with conspicuous appressed setæ.

Male.—Length about 2.5 mm.; wing 2.5 mm.

Female.—Length about 3 mm.; wing 3 mm.

Rostrum and palpi black. Antennæ with the scape black, pruinose; pedicel and flagellum paler, light brown. Head yellow, the centre of vertex dark brown.

Pronotum light brown, variegated on sides with dark brown. Mesonotum chiefly light brown, slightly patterned with darker, the scutellum testaceous yellow. Pleura dark brown, with a very conspicuous silvery-white longitudinal stripe that is narrowly bordered both above and below with somewhat darker brown; dorsopleural region yellow. Halteres with stem yellow, knob infuscated. Legs with fore and middle coxæ infuscated, the posterior pair paler; trochanters yellow; remainder of legs yellow, the fore and middle femora with a single narrow brown ring, the posterior, and, in cases, the middle femora with two such rings, both on the outer third; remainder of legs yellow. Wings with a weak brownish tinge, somewhat darker along the veins and in the stigmal and axillary regions; veins brownish yellow, the macrotrichia darker. Venation: cell M_2 open by atrophy of basal section of M_3 ; vein 2nd A strongly sinuous on distal third.

Abdomen, including hypopygium, dark brown, the subterminal segment light yellow. Male hypopygium with the dististyle three-branched, the longer axial arm dark-coloured, forking at about two-thirds to three-fourths the length, the shorter branch a flattened blade, its sub-truncated apex and outer margin with a comb of short blackened teeth; the longer outer branch a sinuous spine that narrows to the acute tip, at near mid-length with a small blackened spur that is sparsely setuliferous; third branch arising at extreme base of style on lower or mesal margin, extending quite to the apex of the first branch, as described, appearing as a narrow blade, its tip subacute, the surface with a few scattered setigerous punctures.

Gonapophyses single on either side, appearing as a strong curved horn that narrows to the acute tip, the outer surface with conspicuous appressed setæ.

Hab. Peru (Loreto).

Holotype, ♂, Iquitos, March–April, 1931 (*Shannon*).

Allotopotype, ♀. *Paratopotype*, ♂.

The present fly is very similar in its general appearance to *Erioptera* (*Mesocyphona*) *bicinctipes* Alexander and certain other allied forms, differing from all in the structure of the male hypopygium as described. The dististyle in *bicinctipes* is unbranched.

Erioptera (*Mesocyphona*) *cynthia*, sp. n.

General coloration of mesonotum dark brown; pleura striped longitudinally with silvery white and brownish black; halteres pale yellow; legs yellow, the femora with a dark brown subterminal ring; wings with a brownish tinge, unpatterned; male hypopygium with a single dististyle, this appearing as a broadly-flattened blade, on its outer margin at near one-third the length bearing a slender blackened spinoid arm; gonapophyses appearing as single straight black spines.

Male.—Length about 3 mm.; wing 3 mm.

Female.—Length about 4 mm.; wing 4 mm.

Rostrum and palpi dark brown. Antennæ with scape and pedicel black; flagellum of male broken, of female elongate, much paler than the basal segments. Head above dark brown, the front, anterior vertex and orbits more greyish.

Pronotum black above, grey on sides. Mesonotum rather dark brown, the præscutum and scutum virtually unvariegated; scutellum and postnotum more yellowed. Pleura very conspicuously striped longitudinally with brownish black and silvery white, the latter including the dorsopleural membrane and a broad ventral band from behind the fore coxæ across the lower sclerites to the abdomen, passing beneath the wing root. Halteres pale yellow. Legs with the femora obscure brownish yellow, somewhat darker on proximal half, the tip narrowly clearer yellow, preceded by a dark brown ring that is approximately twice as wide; tibiæ and tarsi clear yellow. Wings with a brownish tinge, the prearcular and costal regions clearer yellow; veins and macrotrichia pale brown.

Venation : Cell M_2 open by the atrophy of basal section of M_3 ; vein *2nd A* rather strongly sinuous.

Abdomen brownish black, the hypopygium more intensely so, the eighth segment yellow. Male hypopygium distinctive ; a single dististyle, this appearing as a broadly-flattened blade, yellow on central portion, more infuscated on outer third, the tip broadly obtuse and slightly de-curved ; on outer margin of style at about the basal third with a long, very slender black arm or rod that is slightly more expanded on basal half. Gonapophyses appearing as a simple black spine on either side, nearly straight, narrowed to the acute tip.

Hab. Ecuador (El Oro).

Holotype, ♂, Piñas, Morro Morro, altitude 1500 metres, July 14, 1941 (*Laddey*). *Allotopotype*, ♀, pinned with the type.

Erioptera (Mesocyphona) cynthia is entirely different from the now relatively numerous Neotropical species of the subgenus having unpatterned wings and a single dark femoral ring. The only described species that at all resembles it is *E. (M.) whitei* Alexander, of Central America, which has the hypopygium quite distinct.

LXI.—*New Species of African Cryptocephalus (Chrysomelidæ, Col.)*. By G. E. BRYANT, Imperial Institute of Entomology.

AMONG the interesting collections sent by Dr. J. Risbec from Senegal are four interesting species of *Cryptocephalus*, some feeding on Millet. Two of these have been in the British Museum collection, represented by single specimens, since 1877, bearing manuscript names by C. Suffrian.

The types of the new species have been presented to the British Museum (Natural History).

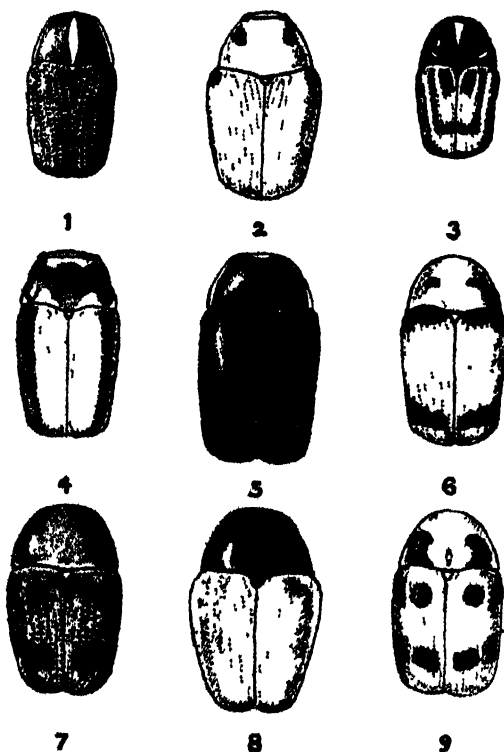
Cryptocephalus hargreavesi, sp. n. (Fig. 1.)

Head and underside flavous, prothorax chestnut brown, the front and side margins flavous, and a median longitudinal flavous line. Elytra chestnut brown, finely and evenly punctate-striate.

Length 4 mm.

Head flavous, finely punctured, the mandibles black. Antennae flavous extending slightly beyond the base of the prothorax, the first segment the longest and more dilated. Prothorax transverse, widest at the base, the

Figs 1-9.



- | | |
|--|---|
| 1. <i>Cryptocephalus hargreavesi</i> ,
sp. n. | 6. <i>Cryptocephalus nigrobasalis</i> ,
sp. n. |
| 2. <i>Cryptocephalus edwardsi</i> , sp. n. | 7 & 9. <i>Cryptocephalus quadrigarius</i> ,
sp. n. |
| 3. <i>Cryptocephalus riebecki</i> , sp. n. | 8. <i>Cryptocephalus flavipennis</i> ,
sp. n. |
| 4. <i>Cryptocephalus fordii</i> , sp. n. | |
| 5. <i>Cryptocephalus chalybeus</i> , sp. n. | |

sides contracted in front, feebly margined, chestnut brown, the side margins broadly flavous, the anterior margin narrowly flavous, and a longitudinal median narrow flavous stripe. Scutellum flavous, triangular, nitid.

Elytra elongate, rounded at the apex, chestnut brown, nitid, finely and evenly punctate-striate. Legs flavous. Underside flavous, the first ventral segment the longest, the second slightly shorter, the third and fourth short and about equal to each other, all somewhat nitid.

UGANDA: Ohua II. 1925 (*H. Hargreaves*).

Allied to *C. flavoornatus* Jac., but differs in its smaller size, darker colour, pale antennæ, and the broader flavous margins to the prothorax.

Cryptocephalus edwardsi, sp. n. (Fig. 2.)

Above ivory coloured, the head and prothorax slightly darker than the elytra, tinged with yellow, the prothorax with two black spots, the elytra with a black spot on the shoulders. Underside and legs black.

Length 4-5 mm.

Head pale ivory yellow, feebly punctured, a median longitudinal impression at the base. Antennæ extending to the middle of the elytra, the three basal segments tinged with flavous, the remainder black. Prothorax transverse, widest at the base, the sides contracted in front, ivory yellow with two black spots on the disc. Scutellum ivory white, triangular, impunctate. Elytra ivory white, paler than the head and prothorax, a black spot on the shoulders, finely punctate-striate, the sides tapering slightly towards the apex. Legs and underside black clothed with very fine short ashy pubescence. The ♂ smaller than the ♀, the ♀ with the apical ventral segment strongly notched.

UGANDA: Ruwenzori Range, Kilembe, 4500 ft.

UGANDA: Namwomba Valley (*F. W. Edwards*), 6500 ft., xii. 1934-i. 1935, 3 specimens.

Allied to *C. decemnotatus* Suff., but differs in its paler colour and pattern, the antennæ are longer, and only the three basal segments flavous.

Cryptocephalus risbeci, sp. n. (Fig. 3.)

Below deep chestnut brown, the head and prothorax deep chestnut brown with some pale flavous markings, the elytra flavous, with deep chestnut-brown markings.

Length 1.5 mm.

♂♀. Head more or less deep chestnut brown, with two longitudinal paler stripes each side of a median longi-

tudinal dark stripe. Antennæ rather short, extending to the base of the prothorax, the six basal segments flavous, the five apical segments dark brown. Prothorax finely and closely punctured, dark chestnut brown with the side margins narrowly flavous, a short median longitudinal pale line, and a short transverse flavous patch near the base on either side. Scutellum dark chestnut brown, triangular impunctate. Elytra with the sides slightly tapering to the apex and thence rounded, punctate-striate, pale flavous with dark chestnut-brown markings, the suture dark, a short dark longitudinal patch extending from near the base, a third of the length of the elytra near the suture, another parallel with the side margin not quite touching the apical margin, and curving inwards, another longitudinal dark line between the fourth and fifth striæ, a broad transverse dark patch before the apex, extending from the suture to the fifth stria. Legs flavous. Underside deep chestnut brown with the apical segment of the abdomen paler. ♀ with the apical ventral segment of the abdomen strongly notched.

SENEGAL: Bambey, 22. ii. 1944 (*J. Risbec*), 4 specimens

SENEGAL: Diorbivol, 21. ii. 1944 (*J. Risbec*), 15 specimens.

Allied to *C. brunneicollis* Suff., from Egypt, but differs in its much darker colour, and well-defined pattern on the elytra.

Cryptocephalus fordi, sp. n. (Fig. 4.)

Below fuscous, the head fulvous, prothorax fulvous, with the anterior and side margins flavous, and two flavous patches at the base, elytra flavous with a broad longitudinal fulvous stripe parallel to the side margins.

Length 3 mm.

♂♀. Head fulvous, with strong scattered punctures, a median longitudinal impression on the basal half. Antennæ extending just beyond the base of the prothorax, the four basal segments fulvous, the remaining seven apical segments black, pubescent and stouter. Prothorax transverse, widest at the base, contracted in front, strongly and not closely punctured, fulvous, the anterior and side margins narrowly flavous, two flavous patches at the base each side of the scutellum. The basal margin produced in the middle. Scutellum flavous,

triangular, nitid. Elytra elongate, parallel-sided, rounded at the apex, strongly punctate-striate, flavous, a broad longitudinal fulvous stripe near the side margins. Legs fulvous. Underside fuscous, clothed with short ashy pubescence.

UGANDA: Kigezi District, Mt. Muhavura, 10,500 ft. (*J. Ford*), 3 specimens.

Somewhat allied in structure to *C. designatus* Bry., but more elongate and flatter, less nitid, and the pattern quite different.

Cryptocephalus chalybæus, sp. n. (Fig. 5.)

Above deep metallic blue, the prothorax with the anterior and side margins narrowly orange, elytra rugose, punctate-striate, the apex tinged with orange.

Length 4-4.5 mm.

Head metallic blue, rugosely punctured, the mandibles and palpi black. Antennæ extending to the middle of the elytra, the first segment with the upperside black, below fulvous, the second and third fulvous, the remainder black and more pubescent. Prothorax nitid, metallic blue, the anterior margin narrowly orange, the side margins more broadly orange, a few very fine scattered punctures. Scutellum metallic blue, nitid, the apex raised. Elytra deep metallic blue, the apex tinged with orange, rugose and punctate-striate. Legs with the femora black, the tibiæ with the upperside black, below fulvous. Underside black, clothed with fine silver pubescence. The first segment of the abdomen, about equal to the second and third together.

UGANDA: Kigezi District, 6000 ft., 20. ix. 1934 (*J. Ford*), 7 specimens.

Allied to *C. elgonensis* Bry.

Cryptocephalus nigrobasalis, sp. n. (Fig. 6.)

Pale flavous, except for a black marking on the base of the head, two small black spots on the prothorax, a transverse black line at the base of the elytra and another near the apex.

Length 4 mm.

Head finely punctured, pale flavous, a longitudinal black median line on the basal half, and a small black

spot near the insertion of the antennæ, palpi flavous. Antennæ flavous, the five apical segments tinged with fuscous, extending just beyond the base of the prothorax, the two basal segments more dilated. Prothorax transverse, widest at the base, rounded towards the front, pale flavous, with two small black spots on the vertex, nitid and impunctate. Scutellum flavous, triangular, nitid. Elytra with the sides almost parallel, tapering slightly to the apex, strongly punctate-striate, flavous, the shoulders and basal portion black, and a broad transverse black band near the apex. Legs flavous. Underside flavous, clothed with very short fine golden pubescence.

SENEGAL: Bambey, 13. ii. 1944 (*J. Risbec*), 2 specimens. Recorded on Millet.

SENEGAL: 1 specimen in the British Museum collection determined by Suffrian as *C. verticalis* Suff., but this is a MS. name and the name is pre-occupied.

Allied to *C. quadrigarius* Bry., but differs in its larger size, and in the position of the black markings.

Cryptocephalus flavipennis, sp. n. (Fig. 8.)

Below black, the head flavous, the prothorax and scutellum shining black, the elytra flavous, evenly and not closely punctate-striate.

Length 5 mm.

♂. Head flavous, impunctate, the labrum and mandibles black, a median longitudinal impression on the basal half between the eyes. Antennæ black, except the second segment, which is tinged with fulvous, the remaining segments black and pubescent, extending almost to the middle of the elytra. Prothorax black, very nitid and impunctate, transverse, widest at the base, the sides contracted in front and feebly margined. Scutellum black, triangular, nitid. Elytra widest at the shoulders, gradually tapering to the apex and thence rounded, entirely flavous, evenly and not closely punctate-striate. Legs entirely black. Underside black, clothed with short ashy pubescence, the second to the fourth ventral segments contracted in the middle.

TANGANYIKA TERRITORY: Morogoro (*A. H. Ritchie*), 26. i. 1925.

Allied to *C. clypeatus* Suff., but differs in the black nitid prothorax and scutellum, the punctures on the elytra not so close and fine, and in having no black spot on the shoulders.

Cryptocephalus quadrigarius, sp. n. (Figs. 7 and 9.)

Pale flavous, prothorax with a black semicircular black patch at each side on the basal half, elytra with four irregular black patches on each, two near the base and two near the apex.

Length 3 mm.

♀. Head pale flavous, a small dark patch at the insertion of the antennæ and a dark median V-mark on the basal half, very finely punctured, and with scattered fine golden pubescence. Antennæ with the four basal segments flavous, the remainder fuscous. Prothorax transverse, widest at the base, narrowed and rounded in front, pale at each side on the basal half. Scutellum pale flavous, triangular, nitid and impunctate. Elytra oblong, the sides almost parallel, rounded at the apex, pale flavous, two black spots near the base on each elytron, one at the shoulders, oblong, the other round, two larger black patches near the apex, finely punctate-striate. Legs and underside flavous, the metasternum with two fuscous markings, the ventral segment of the abdomen, the first the longest, the second to the fourth short and contracted in the middle, all clothed with fine golden pubescence.

♂. Differs in being slightly smaller, in its fulvous colour with the head, flavous, the prothorax narrowly margined with flavous, the elytra with the base and side margins narrowly flavous, the prothorax with two black spots on each side near the base, the elytra with four black spots on each, the two apical spots in some joined, forming a transverse band.

Length 2 mm.

SENEGAL: Diorbivol (*J. Risbec*), 13. ii. 1944, recorded on millet, 11 specimens.

SENEGAL: 1 specimen in British Museum collection determined by Suffrian as *C. quadrigarius* Suff.; but this is a manuscript name, and I am retaining the name.

Allied somewhat to *C. nigrobasalis* Bry., but differs in its paler colour and markings, and in being slightly smaller.

LXII.—*Notes on some Irish Char* (*Salvelinus colii* Günther.

—III.* By ARTHUR E. J. WENT, Department of Agriculture, Fisheries Branch, Dublin.

In a paper published recently (Went, 1945) the present writer gave an account of the distribution of Irish Char and it was then pointed out that these fish are now quite rare in most localities. It was with a view to obtaining as much information as possible on the variability of Irish Char that arrangements were made by the Fisheries Department in Dublin to pay rewards for specimens of Char. As a result a certain amount of material was collected during 1945, amounting to twelve specimens in all from four localities.

(a) Lough Fad, situated in the townland of Meendoran, near Clonmany, Co. Donegal.

Char from this locality have been recorded previously (Went, 1945). In Irish Nat. Journ. (Went, 1946) a specimen of Char from this locality was recorded. Since the previous report was written another specimen has come to hand. The specimen has been deposited in the British Museum (Natural History), London. The details of the specimen, which was captured on an artificial fly, are as follows:—

Date of capture: 13. v. 1945; sex, female; weight, 48 grams; length: 17.4 cms. (to fork of tail) 18.9 cms. (full length). Fourteen gill-rakers on lower part of anterior branchial arch. Interorbital region convex, its width (1.2 cms.), 3.0 in the length of head (3.6 cms.). Depth of body (3.6 cms.), 4.8 in the body length. Least depth of caudal peduncle (1.4 cms.), 0.39 in the length of the head. Pectoral fin (2.9 cms.) extends 0.59 of the distance between bases of pectoral and pelvic fins (4.9 cms.). 120 scales in longitudinal series. Teeth moderate. Maxillary extends to just beyond posterior margin of pupil. The snout was conical and the jaws equal anteriorly. Nine branchiostegals. Dorsal fin: 14 fin rays, 10 branched, its origin nearer the snout than base of caudal fin, longest fin ray 0.72 in length of the head. Anal fin: 12 fin rays, 8 branched.

* Nos. I. and II. have appeared in the Irish Nat. Journ.

The colour of the specimen was recorded as follows :—
Body, upper part iron blue, pale red spots below lateral line, none above ; lower part of body pale pink. No parr marks. Fins : pectoral, pelvic and anal fins tipped with scarlet.

The age and growth were calculated in the usual way (see Went, 1944, p. 205), with the following results :—

Age (in years)	2 + *
Calculated length at end of first winter	7.5 cms.
Calculated length at end of second winter	15.2 cms.

It is worth recording that Prof. Henry Seymour, D.Sc., Professor of Geology, University College, Dublin, in company with a friend, fished Lough Fad in the year 1905 and captured some Char, the biggest of which was about $\frac{1}{2}$ -lb., and the remainder somewhat smaller, being described as the size of a herring. They also caught Char in Mintiaghs Lough, close by, but of a somewhat smaller size than those in Lough Fad. These Char were all taken on rod and line and artificial fly (claret), which was drawn in slowly.

The writer is indebted to Mr. P. O'Doherty, Clonmany, for this specimen.

(b) Kylemore Lough, Co. Galway.

Char from this lake have been recorded previously (Went, 1945, Proc. Roy. Irish Acad. I. B 8, p. 173). Other specimens have now come to hand. Unfortunately the writer was not available when the first fish arrived at the Fisheries Office in Dublin, so that he can only describe it in the preserved (5 per cent. formaline) condition. Even after nearly a week in formaline the pink spots and pink coloration on the belly were quite noticeable, as were the scarlet tips to the pectoral and pelvic fins. The details of this specimen, which has been deposited in the National Museum, Dublin, were as follows :—Date of capture, 8.vii.1945 ; sex, male ; weight, 104 grams ; length, 21.2 cms. (to fork of tail), 23.3 cms. (full length).

Snout conical. Jaws equal anteriorly, lower jaw pointed. Twelve gill-rakers on lower part of anterior branchial arch. Interorbital region convex, its width (1.6 cms.), 2.9 in the length of the head (4.6 cms.). Depth

* Fish in its third year.

of body (4.8 cms.), 4.4 in the body length. Least depth of caudal peduncle (1.7 cms.), 0.37 in the length of the head. Pectoral fin (3.9 cms.), extends 0.61 of the distance between bases of the pectoral and pelvic fins (6.4 cms.), 142 scales in longitudinal series. Teeth moderate. Maxillary extends to just beyond posterior margin of pupil. Nine branchiostegals. Dorsal fin: 13 fin rays, nine branched, its origin nearer the snout than base of caudal fin, longest fin ray (3.2 cms.), 0.70 in the length of the head. Anal fin: 11 fin rays, 7 branched.

The details of the second specimen, which has been deposited in the British Museum (Natural History), London, were as follows:—

Date of capture, 19. vii. 1945; sex not noted; captor, Very Rev. J. Brady, P.P., Killasnett, Manorhamilton, Co. Leitrim; weight 74 grams; length 19.3 cms. (to fork of tail), 20.0 (full length).

Snout conical. Jaws equal anteriorly, lower jaw was pointed. Fourteen gill-rakers on lower part of the anterior branchial arch. Interorbital region convex, its width (1.3 cms.) 3.4 in the length of the head (4.4 cms.). Depth of body (3.7 cms.), 5.2 in the body length. Least depth of caudal peduncle (1.6 cms.), 2.4 in the length of head. Pectoral fin (3.1 cms.) extends 0.61 of the distance between bases of the pectoral and pelvic fins (5.1 cms.), 149 scales in longitudinal series. Teeth moderate. Maxillary extends to just beyond posterior margin of pupil. Twelve branchiostegals. Dorsal fin: 13 fin rays, nine branched, its origin nearer the snout than base of caudal fin, longest fin ray (2.8 cms.), 0.74 in the length of head. Anal fin: eleven fin rays, eight branched.

Colour *.—Body, general appearance, dark above lateral line with silvery reflection, below lateral line silvery grey shading to white with faint pinkish tinge on belly, nine very faint parr marks, several very faint pinkish spots below lateral line. Dorsal fin leaden colour, unspotted. Adipose fin dark. Anal fin, distal half leaden colour, basal whitish shading in to the distal part, the first fin ray pale whitish. Pectoral fins: right fin uniformly grey, left anterior seven rays dark shading to pale shade posteriorly with pinkish tinge.

* Recorded by Mr. G. P. Farran.

The age and the growth of the two specimens were calculated in the usual way (Went, 1944, p. 205), with the following results :—

	First specimen.	Second specimen.
Age	2+ years*.	2+ years*.
Calculated lengths—		
End of first winter	8.7 cms.	9.8 cms.
End of second winter.....	17.2 cms.	16.1 cms.

The writer is indebted to Dame M. Odilon, O.S.B., Benedictine Abbey, Kylemore, Clifden, Co. Galway, for providing these two specimens.

(c) Lough Inagh, Co. Galway.

Char have been known from this lake for many years. A note by H. P. Woodford in 'The Field' in September 1878, records the capture of Char in this locality (see Went, 1945, Proc. Roy. Irish Acad. I. B 8, p. 172). The present specimen was captured by Dr. P. J. Courtney, Letterkenny, Co. Donegal. The details were as follows :—

Date of capture, 19. viii. 1945; sex, male; weight 124 grams.; length 23.7 cms. (to fork of tail), 25.6 cms. (full length).

Snout conical. Jaws equal anteriorly, lower jaw more or less pointed. Fourteen gill-rakers on the lower part of the anterior branchial arch. Interorbital region convex, its width (1.6 cms.) 3.1 in the length of the head (4.9 cms.). Depth of body (5.0 cms.) 4.7 in the body length. Least depth of caudal peduncle (1.8 cms.) 0.37 in the length of the head. Pectoral fin (4.4 cms.) extends 0.68 of the distance between bases of pectoral and pelvic fin (6.5 cms.). 153 scales in longitudinal series. Teeth moderate. Maxillary extends to just beyond pupil of eye. Ten branchiostegals. Dorsal fin: 14 fin rays, ten branched, its origin nearer the snout than base of the caudal fin; longest ray (3.5 cms.), 0.72 in length of the head. Anal fin: twelve fin rays, with eight branched.

Colour.—Body: upper part iron blue, numerous brilliant red spots almost scarlet below lateral line, few above, lower part red, almost scarlet, no parr marks; pectoral fins tipped with scarlet colour, pelvic fins dusky well-defined scarlet markings, first fin rays being whitish;

* Fish in their third year.

anal fin dusky, with splashes of scarlet; dorsal, caudal and adipose fins dusky.

The age and growth of this specimen were as follows:—

Age	3+ years.*
Calculated lengths—	
End of first winter	11.4 cms.
End of second winter	19.4 cms.
End of third winter	22.3 cms.

The writer is also indebted to Dame M. Odilon, O.S.B., Benedictine Abbey, Kylemore, Clifden, Co. Galway, for this specimen.

(d) Lough Mask, Co. Mayo.

A number of Char from this locality were captured during 1945 in the eel nets at Inishard, Co. Mayo. Details were as shown on p. 621:—

Colour.—Unfortunately the colour of specimens 1 and 5 was not recorded, as 1 was not available when they arrived in the Fisheries Office. In specimen 2 the colour on the upper surface was iron blue with very pale pink spots, numerous on the lower surface, but with no pink coloration on the belly. There were twelve distinct parr marks.

Specimen 3 was pale pink along the belly, with pale pink spots. Very pale pink spots were to be found on the dorsal fin and on the basal portion of the caudal fin-rays. There were no parr marks.

Specimen 4 was silver on the belly and olive-brown above, there being no trace of pink coloration except a faint pink coloration on the pelvics. There were ten parr marks.

Specimen 6 had an iron-blue coloration on its upper-part, with a few pink spots above the lateral line. The pink spots were more numerous below the lateral line. There were a few pink spots on the dorsal fin and the pelvics, and pectorals had scarlet tips. The first ray of the pelvic fins were whitish. The belly was silvery, and parr marks were absent.

Specimen 7 had a faint pink tinge to the belly, the upper part of the body was dark brown. A few small pink spots above the lateral line, with more numerous and larger spots below. The pectoral and pelvic fins

* Fish in its fourth year.

Number of Specimen.

	1	2	3	4	5*	6	7	8
Date of capture	24, 8, 45	7, 10, 45	5, 11, 45	26, 11, 45	29, 11, 45	7, 12, 45	11, 12, 45	26, 12, 45
Sex	Male	Male	Female	Male	—	Male	Female	Male
Sex maturity	Imm.	Imm.	Ripe	Imm.	—	Ripe	Partly spent	Spent
Weight in grms.	22.5	13.0	170	26.0	10.5	78.0	128	90.5
Length in cms. :—								
Tip of snout to fork of tail	13.2	12.4	22.9	13.4	12.4	19.3	22.5	20.2
Full length	14.2	13.1	25.2	14.6	13.1	20.9	24.6	21.7
Number of gill-rakers on lower part of anterior branchial arch	—	14	14	13	—	14	13	14
Length of head in cms.	—	2.6	4.3	3.0	—	4.1	4.7	4.6
Width of interorbital region in cms.	—	0.8	1.6	0.9	—	1.3	1.6	1.4
Width of interorbital region in length of head	—	3.3	2.7	3.3	—	3.1	2.9	3.3
Depth of body in cms.	—	2.2	5.3	—	—	—	4.8	4.5
Depth of body in body length	—	5.6	4.3	—	—	—	4.7	4.5
Least depth of caudal peduncle in cms.	—	0.9	2.0	1.0	1.4	1.4	1.9	1.6
Least depth of caudal peduncle in length of head	—	0.35	0.47	0.30	—	0.34	0.40	0.35
Length of pectoral fin in cms.	—	1.8	3.8	2.1	—	3.1	3.9	3.5
Distance between bases of pectoral and pelvic fins in cms.	—	3.3	7.1	3.4	—	5.9	6.8	5.9
*Length of pectoral fin ;								
Distance between bases of pectoral and pelvic fin	—	0.53	0.54	0.60	—	0.53	0.57	0.59
Number of scales in longitudinal series	—	—	150	—	—	152	133	141
Number of branchiostegals	—	9	10	9	—	10	10	9
Number of fin rays (dorsal fin), total	—	12	13	†	—	12	12	13
" " " " branched	—	8	9	†	—	9	8	9
" " " " (anal fin), total	—	10	11	11	—	12	11	12
" " " " branched	—	8	8	8	—	9	8	8
*Length of longest ray of dorsal fin :								
Length of head	—	0.73	0.67	—	—	0.59	0.66	0.63
Diameter of ova (mean) in cms.	—	—	0.30	—	—	—	0.35	—

* Specimen badly crushed in post.

† Dorsal fin damaged.

were tipped with scarlet. There were a few pink spots on the caudal fin, and the first fin ray of the pelvic fin was whitish.

Specimen 8 had a very faint pink tinge to the belly, the upper part of the body being iron blue. Small whitish spots above the lateral line with large and more numerous spots below. Faint pink tinge to the bases of the anal and pelvic fins. Outer parts of pelvic fin rays were tinged with scarlet, as were also those of the pectorals. First fin rays of the pelvic and anal fins were whitish. There were nine faint parr marks present.

In all the specimens the teeth were moderate, the snout conical, the jaws equal anteriorly and the maxillary extended to the hindmost margin of the pupil of the eye, except in specimens 7 and 8, where it extended to the margin of the eye itself. The origin of the dorsal fin was nearer the snout than the base of the caudal fin.

The age and growth of all specimens, save specimen 5, were calculated in the normal way (see Went, 1944, p. 205):—

	Number of Specimen.							
	1	2	3	4	6	7	8	
Age (in years)	1 † *	1 + *	2 + †	1 + *	2 + †	2 + †	3 + †	
Calculated lengths in cms.—								
At end of first winter	7.2	8.4	8.3	7.9	7.0	10.5	6.3	
At end of second winter	—	—	17.5	—	13.7	17.6	11.4	
At end of third winter	—	—	—	—	—	—	15.9	
Length at capture in cms.	13.2	12.4	22.9	13.4	19.3	22.5	20.2	

Specimens 2 and 3 have been deposited in the National Museum, Dublin, and the remaining specimens in the British Museum (Natural History), London. The writer is indebted to Mr. P. May, Ballinrobe, Co. Mayo, for the specimens from Lough Mask.

(e) Lough Gowna, Co. Longford.

Since the paper on the distribution of Irish Char (Went, 1945) was written a reference to Char in this lake

* Fish in its second year.

† Fish in its third year.

‡ Fish in its fourth year.

has been found in W. J. Matson's 'Salmon and Trout-fishing in Ireland' (Dublin, 1910, p. 16). This appears to be the only reference to this locality, and no specimens have been obtained for identification.

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LXIII.—*Fishes of the Genus Decapterus at St. Helena.*

By ETHELWYNN TREWAVAS, D.Sc., British Museum (Natural History).

IN 1945 Mr. J. S. Colman visited St. Helena to report upon the fisheries. He brought to the British Museum (Natural History) a small collection of fishes, among them six specimens of the Carangid genus *Decapterus*.

Two of these bore the local name "Summer Stonebrass" and are identified as *Decapterus punctatus* (Cuvier), a species which does not appear to have been recorded from the island before, although its known distribution, on both sides of the Atlantic, would lead us to expect it there.

Mr. Colman came to the conclusion that Melliss (1875) and Cunningham (1910) had been wrong in thinking that the local names, Stonebrass and Kingston, were applied respectively to younger and older stages of the same species, *Decapterus sanctæ-helenæ* (C. & V.). In support of this opinion Mr. Colman brought to the British Museum two specimens of each, his Kingstons being a little *smaller* than his Stonebrass. The length (to the end of the middle caudal rays) of the former is 190 mm., of the latter 210 and 220 mm. respectively. The most noticeable difference between Mr. Colman's Kingstons and his Stonebrass is that the paired fins are relatively shorter in the former than in the latter.

There are in the British Museum five other specimens of *D. sanctæ-helenæ* from the type island, four collected

by Melliss and one by Cunningham. It is clear from Cunningham's account that he thought this specimen, 380 mm. long, was in the Kingston "phase." Of Melliss's specimens it is reasonable to suppose that the two larger, respectively 375 and 275 mm. long, were Kingstons and the two smaller, 212 and 225 mm., Stonebrass. These three Kingstons and two Stonebrass are then found to agree with Mr. Colman's specimens in the length of the paired fins.

Analysis of other characters shows nothing consistently correlated with the length of the paired fins, except the sex, where this can be determined.

Kingston.

Five specimens, 190 to 380 mm. long.

Length of pectoral fin contained 5.2 to 6.5 times in the total length (to end of middle caudal rays), 1.4 to 1.5 times in the length of head; 1.5 to 1.7 times as long as the postocular part of the head.

Length of pelvic fin 2.24 to 2.5 times in the length of head, 1.85 to 2.45 times in the distance between its origin and the vent.

Gill-rakers on lower part of anterior arch 30 to 39.

Sex.—In one the gonad is minute or destroyed; the other four are males.

Stonebrass.

Four specimens, 210 to 225 mm. long.

Length of pectoral fin contained 4.7 or 4.8 times in the total length, 1.16 to 1.2 times in the length of head; twice to 2.2 times as long as the postocular part of the head.

Length of pelvic fin contained twice to 2.2 times in the length of head, 1.7 to 2.2 times in the distance between its origin and the vent.

Gill-rakers 39 to 43.

Sex.—In one the gonad is small or destroyed. The other three are females.

The wide range of gill-raker counts is striking but may not be significant. The vomerine teeth are variable in both groups, being continuous or in two patches on the head, and present or absent on the shaft

Nichols (1936) suspected that Norman (1935) had included two species in his *D. sanctæ-helenæ*, but the differences in the St. Helena material do not divide the species as Nichols suspected into a form corresponding to *D. macarellus* (C. & V.) and one closely related to *D. muroudsi* (Temminck and Schlegel). Cuvier and Valenciennes stated of both *D. macarellus* and *D. sanctæ-helenæ* that the pectoral was only one-sixth of the total length, and the two small West Indian specimens in the British Museum agree with the Kingston in this character. Unfortunately their gonads are immature, and the viscera of two Ascension specimens are too ill-preserved for determination of sex.

The material at hand is obviously insufficient to settle this question, but the results suggest that field workers should examine material of this and related species to discover whether females have always longer paired fins than males, or whether, on the other hand, two "sibling species" exist side by side distinguished by the length of the fins, and possibly also by some character of coloration or behaviour observable only in the field.

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LXIV.—On the Middle Ear of the *Anomodontia*.

By F. R. PARRINGTON, Cambridge.

It was believed until recently that the stapes of a synapsid reptile was a relatively simple, rod-like structure which lay between the fenestra ovalis and the quadrate. An extra-stapes, presumed to be cartilaginous, was believed to have existed connecting the stapes to the tympanum which was generally thought to have been supported by the reflected lamina of the angular. It is now known, however, that the stapes of these reptiles is very similar

to that of modern lizards. A dorsal process has been demonstrated in the Pelycosauria (Romer and Price, 1940), extra-stapes have been described in Therocephalia (Broom, 1936; Olson, 1944), and in a gorgonopsid and an anomodont (Olson, 1944), while both processes have been found in the cynodonts (Parrington, in press). The discovery of these processes has shown that the tympanum must have been carried, in most cases at least, by the squamosal or quadrate or by both. The general similarity of the extra-stapes found by Olson in an anomodont to the dorsal process found by the writer in a cynodont, suggested that the two processes might be confused. An examination has therefore been made of the condition in *Lyetrosauros*, an aquatic anomodont common in the lower Trias of South Africa.

A specimen in which the quadrate-quadratojugal complex had fallen away from its true position, carrying the stapes with it, was dissected, and the stapes freed from matrix. Difficulty was found in separating the head of the bone from the quadrate ramus of the pterygoid, against which it was lying, and in separating the distal end from the quadrate, and the precise form of these surfaces remains uncertain, but the general characters of the bone are clear.

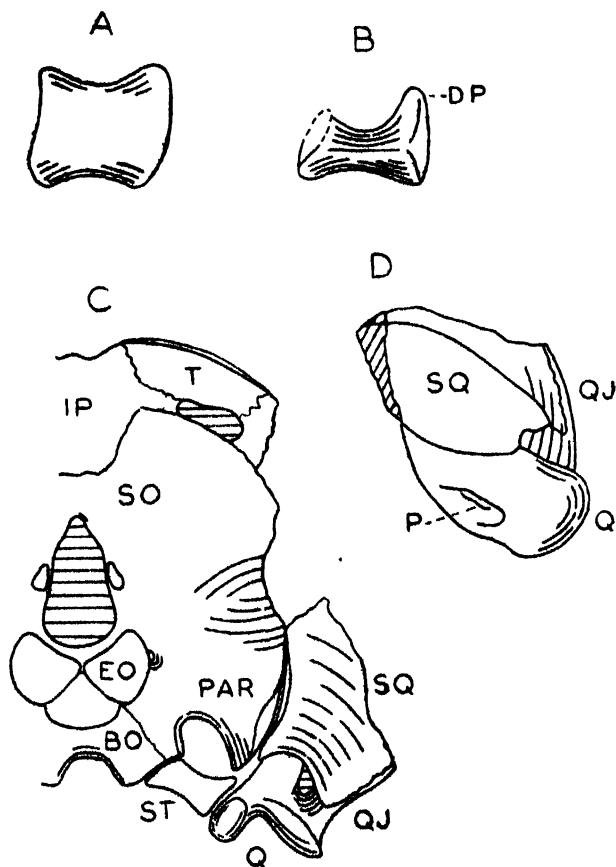
The stapes is short and, ventrally, is a flattened and only slightly constricted bone (fig. 1, A). Dorsally it is more rounded and the extremities expand considerably to form the articulating surfaces, the distal end being larger than the proximal. There is no evidence of a foramen for the stapedia artery. Posteriorly the distal end carries a substantial process which is directed upwards and slightly forwards, and which is almost certainly the same process as that described by Olson. No other process was found.

A second specimen has been prepared to expose the occiput and quadrate-quadratojugal complex in order to determine the relations of the distal end of the stapes to the quadrate and the squamosal.

The general form is well known. The occiput is deep, in conformity with the marked downward development of the snout of this form, while outgrowths from the basioccipital and pro- and opistotics have carried the fenestra ovalis far below the level of the palate. The

ventral extension of the squamosal abuts against the lateral face of the paroccipital process in the usual

Fig. 1.



Lystrosaurus sp.

A, right stapes in ventral view, proximal end to the right, $\times 2$. B, right stapes in posterior view; DP, dorsal process. C, occiput to show relations of squamosal and quadrate-quadratojugal to the paroccipital process; BO, basi-occipital; EO, exoccipital; IP, interparietal; PAR, paroccipital process; Q, quadrate; QJ, quadratojugal; SO, supraoccipital; SQ, squamosal; ST, stapes; T, tabular. D, squamosal, quadrate and quadratojugal from the median aspect; P, pit for the quadrate ramus of the pterygoid.

manner, while its lateral wing is a concave sheet of thin bone, the anterior face of which supports the quadrate

and quadratojugal (fig. 1, C). Its lower border is somewhat curved, exposing the quadrate-quadratojugal foramen in hind view, and forms a downwardly directed projection where it joins the median sheet of the bone which lies against the paroccipital process. There is no boss of bone, as is sometimes figured.

The quadrate cannot be distinguished from the quadratojugal. The articulating surface consists of a median, rather deep, pulley-like structure and, laterally, a more flattened surface which stands higher. The mass which forms these surfaces is continued dorsally as two blades of bone which abut against the anterior face of the lateral component of the squamosal, and which join it by distinct pillars between which is the foramen. The more lateral of the two wings is formed by the quadratojugal, and its outer edge is visible in occipital view. There is some difference of opinion as to whether the quadratojugal forms the outer half of the articulating surface of the complex or only the dorsal process. Comparison of this structure with the quadrate of the lower Permian pelycosaur *Dimetrodon* suggests that the double convex articulating surface is an inheritance from early forms, and that only the outer dorsal wing is formed by the quadratojugal. Some support for this view is afforded by two specimens of very young animals collected by the writer. Here the lateral wings appear to be quite separate from the masses forming the articulating surfaces. The animals are very young (the canine teeth have not yet erupted) and ossification is weak and, perhaps as a consequence, the preservation is such as to leave the question open to doubt.

A line of weakness in the matrix made it possible to remove the squamosal together with the quadrate-quadratojugal complex from the occiput without any damage to the bones (fig. 1, D). Viewed from the median aspect the squamosal is seen to clasp the anterior projection of the quadrate dorsally. The posterior border of this wing of the squamosal is interesting. Starting from the projection formed by the junction of the two wings of the bone, the border runs forwards and downwards a short distance and then curves round to form a notch. The lower border swings forwards and upwards in a steady curve to expose much of the median face of

the wing of the quadrate. This face of the quadrate has a pit opening forward and inwards, which is of considerable interest. The posterior extremity of the quadrate ramus of the pterygoid is visible on the lateral surface of the skull, and careful tests show that it fitted into this pit in the quadrate. The pit has a slightly roughened ledge in its upper part, against which the quadrate ramus may have been fastened. The importance of this feature lies in the fact that it strongly suggests that the ramus, being fastened to the quadrate, denied the possibility of any forward movement of the latter bone, a movement which has been postulated by the writer in the cynodonts. Together with the apparently undisturbed condition of this region of the specimen, it also indicates that the quadrate-quadratojugal complex lies in its true position relative to the squamosal.

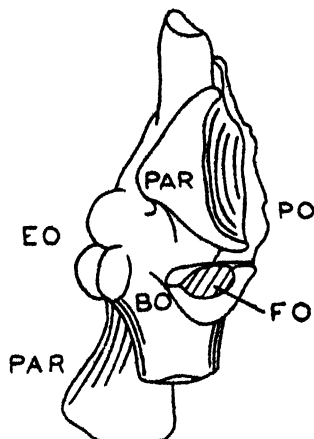
The stapes is lying nearly in its true position between the fenestra ovalis and the quadrate, touching both, but it has fallen somewhat so that it is largely the ventral surface which is exposed in occipital view.

The fenestra ovalis is available for examination in a third specimen. It is oval in shape and is surrounded medianly by a thick lip formed from the basioccipital and laterally by downgrowths from the prootic and opisotic. The suture between these bones can be traced some distance (fig. 2). The oval shape of the opening, which matches the head of the stapes, and its lateral position in the downwardly directed process, serve as guides in placing the stapes in its approximate position (fig. 3). The stapedia process, which is believed to be the dorsal process, appears to have contacted the outer extremity of the paroccipital process somewhat posteriorly to its lowest point, while the lower half of the distal end of the bone rested against the median face of the quadrate. This brings the dorsal half of the distal end opposite the space below the posterior extension of the vertical component of the squamosal. The tympanum must therefore be presumed to have been stretched across this space, in which case it was carried by the squamosal and the quadrate. Only a short extra-stapes is required to join the stapes to the tympanum if it was held in this position.

The notch in the posterior border of the vertical component of the squamosal remains a problem. It is

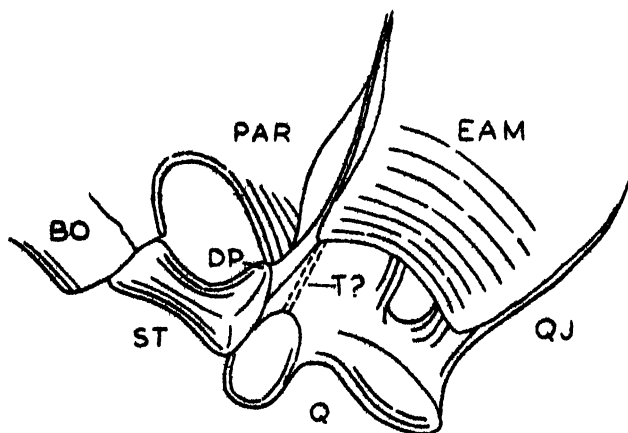
not considered likely that it could have supported the tympanum without the aid of the quadrate since, as

Fig. 2.

*Lystrosaurus* sp.

Occiput and brain-case viewed from the right side and below.
PO, pro-otic; FO, fenestra ovalis.

Fig. 3.

*Lystrosaurus* sp.

Restoration of ear region to show probable position of the tympanum, T? and the external auditory meatus, EAM. $\times 2$.

restored, it lies too close to the lateral face of the paroccipital process and too high above the dorsal process

of the stapes for an extra-stapes to have contacted it, except at a very acute angle.

The external auditory meatus was presumably housed in the concavity formed by the lower part of the lateral wing of the squamosal. This is comparable to the position demonstrated by more complete development in the Cynodontia.

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LXV.—*On the Terrestrial Isopod Hyaloniscus vividus* (Koch). By WALTER E. COLLINGE, D.Sc.

FOR many years I have doubted if the terrestrial isopod described by Kinahan in 1858, from Portlaw, Co. Waterford, Ireland, under the name of *Philougrina vivida* was the same species as that described by Koch in 1841 as *Itea vivida*.

Prof. A. Vandel (*in litt.* Nov. 4, 1938) stated, "*Trichoniscus vividus* is essentially of England and Ireland, but we have mingled under this name two very different forms. The true *T. vividus* is a *Hyaloniscus*, it corresponds to the *T. vividus* of Koch. It is a form very widespread in Central Europe, but which only exists in France entirely on the frontiers (Strasbourg, Bellegarde)." An opinion from such an authority at once led me to make an investigation of the two forms.

For the Irish specimens I am indebted to the kindness of Dr. R. S. Bagnall.

In 1841, C. L. Koch* described a terrestrial isopod under

* I wish to express my thanks to Dr. Isabella Gordon, of the British Museum (Nat. Hist.), for her kindness in sending me a copy of Koch's original description and figure.

the name *Itea vivida* as follows:—

1. ferreo-nigra segmentorum marginibus, lineolis dorsalibus obliquis and maculis lateralibus albis.

Länge 2½ . . .

Koch. Dtschl. Crust. Myr. u. Arachn. H. 34. n. 4. Körper - und Schwanzringe glatt und sehr glanzend, erstere mässig, letztere schwach gewölbt. Der Kopf am Hinterrande regelmässig gerundet. Die Fühler etwas lang, nicht dick, glänzend an der Spitze der Mittelglieder einzelne kurze Borstchen, das Endglied sehr dünn und lang. Die drei vorderen Körperringe mit geradem Hinterrande, an den folgenden die Hinterrandswinkel spitz und stufenweise mehr verlängert. Die Schwanzringe am Hinterrande gerade, mit scharfen, wenig vorgezogenen Seiten winkeln. Die Schwanzgabel lang, der innere arm so lang als das Endglied der äussern, äumn nadefförmig, der äussere dicker und pfriemenförmig dée Endborste auf diesem sehr kurz.

Die Grundfarbe des Kopfes, der Körper - und Schwanzringe eisenfarbig schwartz eisenfarbig schwartz, alle Ringe mit weissen Kanten, die des interandes des Kopfes und der Körperringe sehr fein, die der Seiten der lebzttern unde die Hinterrandakanten des Schwanze's breiter; auf dem Rücken beiderseitz feine Schiefstruchen und in den Seiten der sechs hintern Körperringe ein ziemlich grosser Langsfleck ebenfalls weiss, letztere, eine deutliche Längsreihe bilden. Der Fühler dunkelbraun mit feinen weissen Spitzenrändern der Mittelglieder, das Endglied an der Endhälfte ins Weisse übergehend. Die Schwanzabel postbräunlich. Die Unterseite sammt den Beinen bräunlich, die Glider der letztern an der Wurzel, das Endglied aber an der Spitze, und die Schwanzschuppen weiss.

Der Wohnort ist unbekannt. Graf Jenison erhielt sie von [? von in text] Wien."

Kinahan * in 1858 recorded and figured from Portlaw, Co. Waterford, Ireland, a species of the same name, under the generic title of *Philougria*. His description reads:—

Philougria vivida (Koch sp.).

"Corpore laevi splendide, ovali. Telson truncate-triangulato; apice recto, *superne profunde* sulcato, non emarginato.

* Nat. Hist. Rev. 1858, p. 197, pl. xxiii. figs. 2-2f.

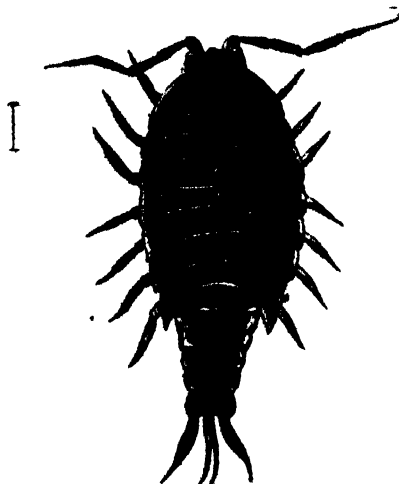
Colore : fusco subtilissime albide-maculato.

Sub musco, lapidibusque in collibus ad Portlaw, Co. Waterford.

Hiberniam, non rare inveniam.

Longitudo, 25 unc."

Kinahan wrongly describes the telson as truncate, whereas the emargination is correctly shown in the figure, the pleura in the same drawing are not quite accurate.



Hyaloniscus vividus (Koch).

Copy of the original figure from Panzer, Deutsch. Insecten. Koch, Crustacea, fig. 180.
(Del. Miss O. F. Tassart.)

Bate and Westwood* describe this species as follows :
"Terminal segment of the pleon triangular, truncate, the extremity nearly straight, without any emargination ; above, deeply sulcated. Outer antennæ ten-jointed. Colour brown, marked with small buff-white dots."

They add, "The general colours of this species is claret brown, marbled with white when seen under a lens."

Here again the description does not agree with the figure.

Still later Budde-Lund† in 1885 described a *Trichoniscus vividus* from France as follows :--

"Oblonge ovalis, leviter convexus, lævis, nitidus.

* Brit. Ses.-eyed Crust. 1868, ii. p. 458, 7 figs.

† Crust. Isop. Terres. 1885, p. 245.

Antennæ exteriores corpus dimidium fere æquantes; flagellum obscure sex-septemarticulatum, articulis ultimis apice fasciculo tubulorum et setis paucis iunctus.

Oculi majores, simplices.

Trunci annuli tres priores margine posteriore curvato, angulis posticus rotundata obtusis; annulus quartus margine postice subtransverso, angulis posticis rotundate subrectis; annuli tres posteriores medio post magis sinuato angulis postico sensim acutioribus.

Cauda trunco abrupte angustior; annuli duo priores ceteris vix breviores; epimera omnium annulorum minima. Annulus analis lateribus incurvis apice late truncato, angulis posticis subacutis supra excavatus.

Rami terminales longitudine æquales, ramus exterior interiore crassior.

Colore flavo vel fusco brunneus, albida uroratus.

Long. 5.5-6 mm. Lat. 2.25-2.5 mm. Alt. 1-1.2 mm.

Patria: Gallia, Vindobonum? Hibernia? Plura exemplæa cl. Simon ad "La Preste" in Gallia meridionali lecta, vidi."

The figure given by Webb and Sillem* is of *Hyaloniscus vividus* (Koch).

After a careful examination of the Irish and the Continental forms I am of opinion that they are quite distinct from one another. The Irish form is a true *Trichoniscus*, whereas the Continental form belongs to the genus *Hyaloniscus*, as pointed out by Prof. Vandel.

It is therefore necessary to propose a new specific name for the Irish species, and it gives me great pleasure to associate with it the name of Prof. A. Vandel, of the University of Toulouse, whose erudite researches on the origin, evolution and classification of the Oniscoidea have so conspicuously added to and widened our knowledge of the Terrestrial Isopoda.

Trichoniscus vandeli, sp. n., non *T. vividus* (Koch)
or Budde-Lund = *T. vividus* (Kinahan).

Body oval, smooth and glossy, with very small, widely separated tubercles and small dots or pits. Cephalon with frontal margin strongly arcuate. Antennule three-jointed. Antennæ with a blunt triangular spine on the meropodite; flagellum without spines, with five to ten joints (av. 9.).

* 'The British Woodlice,' 1906, pl. iv.

Mesosome with the pleural plates of segments one and two bluntly rounded terminally, three to seven produced backwardly as long spinous processes. Metasome short and broad. Telson triangular, emarginate terminally,

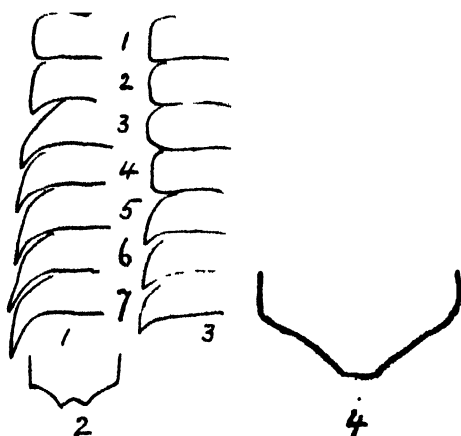


Fig. 1.—*Trichoniscus vandelius*, sp. n. Segments of the mesosoma.
 Fig. 2.—*Trichoniscus vandelius*, sp. n. Telson.
 Fig. 3.—*Hyaloniscus vividus* (Koch). Segments of the mesosoma.
 Fig. 4.—*Hyaloniscus vividus* (Koch). Telson.

dorsally with deep sulcations. Uropoda with the exopodite very little longer than the eudopodite, but stouter, both with few lateral setæ, exopodite with long, single terminal seta.

Length 8-8.5 mm.

Colour claret-brown, with faint buff-white marbling.

Locality.—Black Head, Co. Antrim, Ireland, ii. ix. 1935.
 A. H. Litster (Dr. R. S. Bagnall).

Apart from a number of minor differences, the two most striking features separating *T. vandelius* from *H. vividus* (Koch) are—(i.) The form and development of the pleural plates of the segments of the mesosoma; (ii.) the emarginate terminal portion of the telson.

In general form *T. vandelius* is broader than *H. vividus*; the first and second segments of the metasome being partly hidden by the seventh segment of the mesosoma, whereas in *H. vividus* all the six segments are visible.

The figures given by Koch and Kinahan are only indifferent ones, but it is at once clear that the two represent widely separated species.

LXVI.—A new Species of *Ptoleria* Stål (Fulgoroidea : Cixiidae) from Sierra Leone. By F. MUIR.

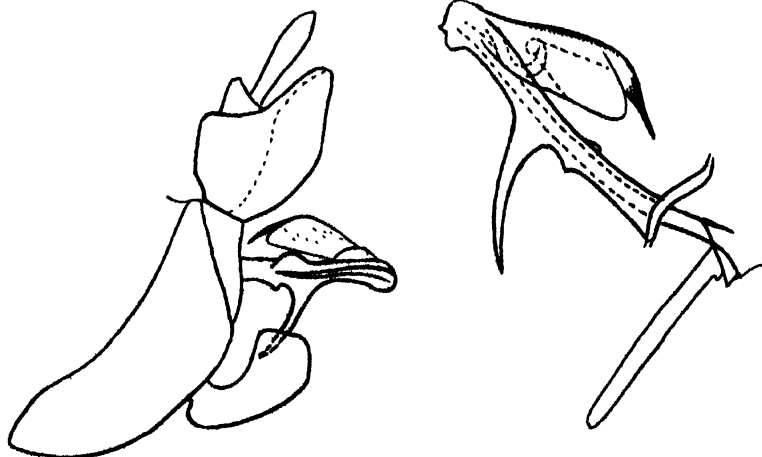
PTOLERIA Stål.

Stål, 1859. Berl. Ent. Zeit. iii. p. 321.
Genotype : *P. arcuigera*, Stål.

Vertex wider than long (1.6 to 1), sides and base straight, apex very slightly emarginate, a light longitudinal line in middle, but no carina ; frons as wide as long, median carina partly indistinct, median ocellus obscure in most specimens. Hind margin of pronotum

Fig. 1.

Fig. 2.



Ptoleria africana.

Fig. 1.—Male genitalia, left side. Fig. 2.—Aedeagus, right side.

angularly emarginate, mesonotum tricarinate. Sc+R fork not far from base, Cu 1 fork more distad, M fork about level with node, M 3+4 touching Cu1 for a short distance, M with five veins (1, 1 a, 2, 3, 4).

Head, legs, abdomen and middle of pronotum and mesonotum light stramineous ; frons, clypeus and middle of mesonotum slightly speckled ; lateral portions of pronotum and mesonotum darker brown. Tegmina hyaline, slightly yellowish, inclined to fuscous over clavus, Cu and apical cells ; a few darker marks in clavus, the commissure and marginal cell of clavus whitish with

black granules, all other granules on tegmina of same colour as veins. Wings slightly opaque, veins light.

Pygofer short, laterally compressed. Anal segment large, concave on ventral surface, apex widely rounded. Periandrium with two large spines, one arising from left side near apex and the other from middle of ventral surface.

Female similar in colour and build to the male. Ovipositor complete, as long as anal segment which is longer than wide with a longitudinal depression, and bears no wax-secreting glands.

Described from three males and four females from Bomatok, Sierra Leone (*E. Hargreaves*, 27. v. 25).

(Note.—Muir did not record in his manuscript the dimensions of this species, and the material, with the exception of one post-femur and the mounted male genitalia was destroyed while en route from Honolulu to the British Museum. It is evident from these portions that the species is of usual size for the genus, i. e., length about 3.1 mm.; tegmen about 5.0 mm. The mounted genitalia constitute recognisable type material, and are in the British Museum (Natural History). Fig. 1 was prepared by Muir, fig. 2 by the annotator from the type.—R. G. Fennah.)

LXVII.—*Gammarus ochlos* (*nom. nov.*), *Crustacea*, *Amphipoda*. By D. M. REID, Department of Biology, Harrow School.

WITH the end of the war and the return of the literature which had been housed in cellars, I find that the name *Gammarus sarsi* which I gave to the amphipod *Gammarus campylops* Leach, as described and figured by G. O. Sars in the 'Crustacea of Norway,' has already been occupied by *G. sarsi* Sowinski.

In order to end (I sincerely hope) the confusion which has been caused by this species since the name was first printed—wrongly—*campylops*, I desire to change its name to *Gammarus ochlos* to distinguish it once and for all, and at the same time indicate that it has been a pest to all who have worked with the genus *Gammarus*.

Appended is a list of its changes of nomenclature, etc. :—

G. campylops Leach, *Edinb. Enc.* 1813-14.

G. campylops Leach, *Trans. Linn. Soc.* xi. 1815.

- G. camptalops* Leach (in) Samouelle, Ent. Compen. 1819.
G. camphylops Leach (in) H. Milne Edwards, Ann. Sci. nat. 1830.
G. campylops Leach (in) Bate and Westwood, Brit. Sessile-Eyed Crustacea, London, 1862.
G. campylops Leach (in) G. O. Sars, 'Crustacea of Norway,' 1894.
G. sarsi Reid, Ann. & Mag. Nat. Hist. (11), x. 1943.
G. ochlos Reid.

The *G. campylops* described by Leach did not correspond with the diagrams drawn from his specimens by Bate and Westwood, as was pointed out by Walker (1911) when he examined the last of Leach's specimens. Walker concluded that the specimens were merely aberrant forms of *Marinogammarus marinus* (Leach).

The *G. campylops* described by G. O. Sars is quite different from Leach's species, but, like it, has the characteristic of being elusive. Its name faded from the literature because few, if any, specimens were recognised. This is perhaps to be accounted for by the fact that it is without salient physical characteristics and, indeed, is rather like a small form of *Gammarus zaddachi* Sexton (the "hairless" or saline water form).

It is this animal whose name is to be changed to *Gammarus ochlos*.

Reference.

- WALKER, A. C. 1911. Ann. & Mag. Nat. Hist. viii. (7) p. 397.

BIBLIOGRAPHICAL NOTICE.

Vertebrate Paleontology By A. S. ROMER. Pp. viii.+687, 377 text-figs. (Second Edition, The University of Chicago Press, 1945.) Price 39s.

THE issue of a second edition of this valuable book, long overdue after twelve years, will be welcomed warmly by all those interested in the study of fossil vertebrate animals.

To say that it is the best book of its kind hardly does it justice, for there has been none other of the same type and scope since Smith Woodward's pioneer 'Outlines of Vertebrate Paleontology,' of nearly half a century ago—a comparison of the two books gives a very clear picture of the great advances in knowledge and the changes in outlook and treatment of

the subject that have taken place during that time. It is in no sense a criticism of Prof. Romer's volume to say that it does not, as was suggested in the preface to the first edition, replace the English editions of Zittel's text-book, for, in spite of the somewhat archaic format, Zittel remains the essential reference-book for those engaged in original research, a rôle which this latest book is scarcely designed to fill. Nevertheless, not only teachers and students but all those who consider themselves authorities on some branch of the subject, will find the new work necessary, for it provides a clearly written, comprehensive and up-to-date survey of their own and related interests.

The general arrangement of the book is admirable. As in the first edition, it opens with an introductory chapter dealing with the fundamentals of the subjects involved—evolution and taxonomy in general, and the ancestry, structure and classification of the vertebrates are all simply and adequately explained.

The greater part of the book is, of course, a systematic account of the extinct vertebrates, arranged in the usual order from Agnatha to Mammalia—but for once both the birds and the primates are put firmly in their proper places; the former, as an offshoot of the reptiles, are interpolated before the synapsids, while man and his relations are not accorded the customary flattery of having the last word, but are inserted between the insectivores and the carnivores. In every group due attention is given to reputed ancestry and known distribution in time and space, and each is introduced by a generalised account before the more detailed description is given of the lesser sub-divisions; but nowhere is there an attempt to describe genera as such, only those illustrative of the general story being mentioned. This plan adds greatly to the readability of the book and makes it greatly more acceptable to the less specialised student.

A great deal of critical information has come to hand since the first edition appeared in 1933, and to incorporate this the author has re-written about one-half of the text and subjected the whole to the criticism of leading specialists on the groups concerned. The book, therefore, contains the latest opinions, but is nevertheless well balanced and agreeably free from the more extreme theories that from time to time gain temporary currency on either side of the Atlantic. Here, however, we may suggest that the re-naming of the dermal bones of the skull of the Actinopterygian fishes is somewhat premature, particularly in a text-book, however much justification there may be for the new correlation between the roof-bones of the Choanate fishes and the Tetrapods; for, as the author points out, "it is likely that we shall never be sure

of all the homologies between the bony-fish groups"—and certainly not before there is better direct evidence of common ancestry than at present.

Another point regarding fishes that we would question is the implied suggestion that Holosteans could have arisen without passing through a sub-Holostean stage (p. 96).

In several ways the second edition shows improvements on the original—the short systematic appendix has been expanded into a more comprehensive list of fossil genera and three excellent chapters (one for each era) have been added, giving a summary of vertebrate faunal history.

The bibliography is, as before, restricted more or less to "key-works" and the more modern literature arranged group by group, each pleasantly preceded by a brief note on the workers in that particular field.

The book is lavishly illustrated by finely drawn text-figures, 377 in number; but it is in respect of these that we would offer some points of criticism. Several of the new text-figures, especially those of fishes with fine fin-rays (e. g., nos. 20, 25, 26, 59, 67, 70, 80, 86, 88, 92), have been spoiled by over-reduction, and in the copies that we have seen much detail has been masked by unsightly smears. This is partly due to the poor quality of the paper, for some of the figures have come through to the other side of the pages, and for this war-time conditions must doubtless be blamed. All the text-figures are restorations of which the restored parts are not easily detected, and their very perfection is misleading, for fine drawings can give a spurious authority that the less perfect originals do not warrant.

One other point concerns the legends of the figures, for here and there we detect evidence of carelessness—for example, in fig. 20 the upper left figure is of *Anglaspis* and not *Poraspis*, while the left centre figure is of *Pteraspis*, not *Anglaspis*; in fig. 22 the orbital region of fig. A is certainly inaccurate; while fig. C is of *Pteraspis*, and figs. D and F have been interchanged (there are also slight inaccuracies in attribution to authors in both figs. 20 and 22); in fig. 52 *Rhina* is neither a skate nor a ray; in fig. 63 the much restored palaeoniscoid palate is not based on *Haplolepis* (carefully changed from *Eurylepis* in the last edition), but apparently on *Eurymotus*; in fig. 87 the still-existing carangoid *Mene* is described as a "fossil flounder"; while in fig. 90 the upper restoration, of the Liassic *Undina*, is described as being "*Macropoma*, a Cretaceous oelacanth."

These, however, are but minor blemishes in a first-class book, and will doubtless disappear in future editions.

ERROL I. WHITE.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 94. OCTOBER 1945.

LXVIII. — *Upper Llandovery Brachiopoda from Coneygore Coppice and Old Storridge Common, near Alfrick, Worcestershire.* By ARCHIE LAMONT, Grant Institute of Geology, West Mains Road, Edinburgh, and D. L. F. GILBERT, formerly of the University of Birmingham.

(Plates III.–VII.)

BEFORE joining the army the junior author collected a considerable number of fossils from Coneygore Coppice and Old Storridge Common, a little over a mile south of Alfrick, Worcestershire (Geological 1-inch map, Old Series, Sheet 55 S.E.), and made progress in identifying, describing and photographing *Dolerorthis psygma*, sp. nov. and *Leptaena wisgoriensis*, sp. nov. Subsequently more material was broken up, more specimens identified and additional information obtained. The site of Gunwick Mill, in the valley opposite Sheephill Coppice, was one of John Phillips's and J. W. Salter's fossil localities (1848, p. 330, etc.) and brachiopod material from it was described by T. Davidson (1866–71, pp. 39, 297, etc.). The material from Gunwick Mill contains *Pentamerus laevis* J. Sowerby (= *P. oblongus*; see J. K. S. St. Joseph, 1938, pp. 274–285, figs. 4–7), as was recorded by Phillips (1848, p. 292), and as can be verified from one of Davidson's specimens (GSM.* 11461). Many of the fossils dealt with in this paper are from the same kind of fine, calcareous sandstone as that at Gunwick disused paper-mill, and belong to the

* GSM. = Geological Survey Museum, London.

Pentamerus Beds of the Upper Llandovery. It should be noted, however, that *P. lævis* occurs only at Localities 3 and 5 (*vide infra*): at Locality 1, the Pentameracea are represented by *S. lirata* (J. de C. Sowerby), and its varieties *S. lirata* forma α St. Joseph, and *S. lirata* var. nov. *diota*.

An outline of the assemblage obtained from Coneygore Coppice and Old Storridge Common is given below. In it abundant fossils are distinguished by the letter "c." The numbers refer to localities as follows:—

Locality 1.—Sunk track through Coneygore Coppice, 1200 yards east of Lower Tundridge Farm, and 690 yards north by $6\frac{1}{2}^{\circ}$ east from the Plymouth Brethren's Meeting House. See 6-inch Ordnance Map of Worcestershire, Sheet 32 S.E.

Locality 2.—Ride through Coneygore Coppice, 60 yards south by 25° west of Locality 1, and 620 yards north by $4\frac{1}{2}^{\circ}$ east from the Plymouth Brethren's Meeting House.

Locality 3.—Old Quarries on the south side of Old Storridge Common, 440 yards north of the Beck Reservoir. Loose blocks.

Locality 4.—Old Quarry on north-west side of Old Storridge Common, $\frac{3}{4}$ mile east of Lower Tundridge Farm, and 760 yards north by 15° west of the Beck Reservoir.

Locality 5.—Slopes of North-north-east Valley, bounding south-east end of Sheephill Coppice, south by 30° west from Footbridge across the Mill Stream. Probable Gunwick Mill locality of earlier writers.

BRACHIOPODA.

Atrypa reticularis Linnæus. 1, 2, 3, 5; c.

Brachyprion arenaceus (Salter MS.) forma typica. 1, 3; c.

Brachyprion arenaceus (Salter MS.) with incipient geniculation. 1.

Brachyprion arenaceus var. nov. *geniculatus*. 1, 3.

Brachyprion arenaceus aff. var. *geniculatus*. 1.

Brachyprion arenaceus var. nov. *lobatus*. 5.

Brachyprion arenaceus aff. var. *lobatus*. 1.

Camarotoechia numerosa, sp. nov. 3.

Camarotoechia transversaria, sp. nov. 1.

Crispella anglica, sp. nov. 3.

- Crispella* sp. 1.
Cælospira hemispherica (J. de C. Sowerby). 1, 3, 4, 5.
Dolerorthis psygma, sp. nov. 1, 2, 3; c.
Eospirifer radiatus (J. de C. Sowerby). 3.
Leptaena wisgoriensis, sp. nov. 1, 3; c.
Leptella (*Merciella*) *vesper*, subgen. et sp. nov. 1; c.
Leptostrophia cf. *filosa* var. *mullochiensis* Reed. 1.
Lingula cf. *crumena* Phillips. 4.
Lingula cf. *pseudoparallela* Phillips emend. Stubblefield.
4. *Mendacella challinori* Lamont. 1, 3; c especially at
Locality 1.
Mendacella sp. 3.
Pentamerus lævis J. Sowerby. 3, 5; c.
Platystrophia mimela, sp. nov. 1.
Plectodonta millinensis cf. var. *canastonensis* O. T. Jones.
3. *Stegerhynchus* (?) cf. *weaveri* (Saltor MS.). 3.
Stricklandia lirata (J. de C. Sowerby) forma typica
St. Joseph. 1; c.
Stricklandia lirata forma α St. Joseph. 1; c.
Stricklandia lirata var. nov. *diota*. 1.

TRILOBITA.

- Calymene* cf. *planicurvata* Shirley. 3.
Calymene cf. *replicata* Shirley. 3.
Calymene sp. 3.
Dalmanites weaveri var. *tenuimucronata* Whittard. 3.
Encrinurus cf. *mullochiensis* Reed (3 large tubercles on
base of intergenal spine as in *E. laurentinus* Twenhofel).
1, 3.
Encrinurus cf. *onniensis* Whittard. 3.
Encrinurus shelvensis Whittard. 1, 3.
Encrinurus sp. 3, 5.
? *Illænus* sp. 3.
Leonaspis cf. *erinaceus* var. *salopiensis* Whittard and
L. marklini (Angelin). 1.
Prætus sp. 3.
Warburgella cf. *stokesi* (Murchison). 3.

CRUSTACEA—MACHAERIDIA.

- Cf. *Anatifopsis* Barrande. 3.

ANNELIDA.

- Cornulites* cf. *serpularius* Schlotheim. 1, 3.
Tentaculites cf. *annulatus* Schlotheim and *T. minutus* Hall. 3.

BRYOZOA.

- ? *Helopera* or *Ptilodictya* sp. 3.
 Cf. *Ptilodictya gladiola* Billings. 3.
 ? *Trematophora* sp. 1.

ANTHOZOA.

- Favosites* cf. *asper* d'Orbigny. 1, 3, 5; c.
Streptelasma. sp. 1, 3.

ECHINODERMATA.

- Crinoid ossicles*. 4; c. At other localities the crinoid ossicles are very few and small, or absent altogether.

GASTROPODA.

- ? *Archinacella* sp. 1.
Bellerophon.
Cyclonema crebriaria cf. var. *rugatum* Pitcher. 1, 3, 4.
 ? *Fusispira* sp. 1.
Holopella (?) cf. *cancellata* (J. de C. Sowerby). 3.
Liospira cf. *lenticularis* (J. de C. Sowerby). 1.
Liospira cf. *uriconiensis* Pitcher. 1.
Lophospira sp. 1, 3.
*Pythmenema** *prænuntium* (Phillips), gen. nov. 1, 3; c.

LAMELLIBRANCHIA.

- Ctenodonta eastnori* J. de C. Sowerby. 4.
Ctenodonta rhomboidea (Phillips). 4.
Modiolopsis sp. 4.
 ? *Orthonota* or *Palæosolen* sp. 4.

* Referred by Phillips (1848, p. 357, pl. xiv. figs. 11, 11a) to *Euomphalus*; followed by Stubblefield (1938, p. 89). *Pythmenema* is distinguished by having several spiral keels—three strong and two alternating weaker ones—on the base of the shell, i.e., anterior to the slit band. The spire is depressed as in *Euomphalidæ* de Koninck, and unlike that of typical *Trochonematidæ* Zittel.

BRACHIOPODA.

Order PROTREMATA Beecher, 1891.

Suborder ORTHOIDEA Schuchert and Cooper, 1932.

Superfamily Orthacea Walcott and Schuchert, 1908.

Family Orthidae Woodward, 1852, *emend.* Schuchert and Cooper, 1932.

Subfamily HESPERORTHINÆ Schuchert and Cooper, 1931.

Genus DOLERORTHIS Schuchert and Cooper, 1931.

Dolerorthis psamma, sp. nov.

(Greek *ψῆμα* = a fan.)

(Pl. III. figs. 1-4; text-fig. 1.)

Diagnosis.—Exterior: shell biconvex, wider than long, maximum width at one third the length, semi-circular in front. Hinge-line straight and three quarters the maximum width. Cardinal extremities rounded. Dorsal valve the more convex, ventral valve flattening out distally or slightly resupinate. Lateral commissure nearly straight, anterior commissure with a broad very low fold, corresponding with flattening of ventral valve. Ventral interarea apsacline, wide, triangular, umbonal angle 140° , with beak a little incurved. Dorsal interarea anacline, about one third length of, and a little less wide than the ventral interarea, umbonal angle 165° . Beak low projecting a short distance behind hinge-line, not incurved. Both valves have twenty strong, rounded costae, slightly narrower than the interspaces, all reaching umbonal region.

Ventral interior: delthyrium narrow, delthyrial cavity shallow, about one and a half times as wide deep. Two moderately strong dental plates diverge at 60° and are continuous with a low ridge surrounding the pentagonal, slightly raised, muscular area; adductor impression long and narrow in contrast with diductor scars. Two main vascular trunks median, subparallel; numerous radial pallial ridges. Costation clearly reproduced on the interior of valve, each "rib" divided by a median furrow distally.

Dorsal interior: notothyrium open, cavity shallow, twice as wide as deep. Cardinal process linear, slightly thickened anteriorly. Crural plates short, thick, tri-

angular, widest in front. Notothyrial platform continued forward in a short median rise separating two small hollows. Muscle-scars, pallial markings, etc., not seen. Internal costation strongly marked with linear depressions, deepening anteriorly to give crenulate margin. These furrows on the internal ribs are not reproduced on the exterior of the shell.

Dimensions :—

Length	.....	14-23 mm.
Breadth	.....	20-26 mm.
Thickness	.....	7mm. (ventral 3 mm., dorsal 4 mm.).

Syntypes.—BU.* Geol. Dept. Museum, Fig. Coll. 350 a-b, 351.

Paratype.—BU. 352 a-b.

Horizon.—Upper Llandovery (including Pentamerus Beds).

Localities.—Sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm; ride through Coneygore Coppice (locality 2), 620 yards north by $4\frac{1}{2}^{\circ}$ east the Plymouth Brethren's Meeting House; loose blocks, at Old Quarries (locality 3), 440 yards north of the Beck Reservoir, Old Storridge Common; also in limestone block with *streptelasma* cf. *crassiseptatum* Smith (1930, pp. 314-316, fig. 8, pl. xxviii. fig. 21) of Silurian age from Permian Breccia, Northfield, Warwickshire; and in Evans Collection of fossiliferous Middle Bunter pebbles collected in Birmingham (National Museum of Wales, 37.110 GR. 288).

Discussion.—In the Syntype BU. 351 the delthyrium is obscured. In the paratype BU. 352 a from the same neighbourhood it has been observed as narrow and slitlike, a feature often present in the subfamily Hesperorthinæ and due to marginal growths in the delthyrium (Schuchert and Cooper, 1932, p. 85). This observation has been made on a larger and possibly older individual in which it is notable that the internal ribbing is fainter than in the syntype. The paratype also provides information about ventral pallial markings. Slight variation occurs in the convexity of the dorsal valves. The length to which the internal ribs are furrowed also varies, possibly with age.

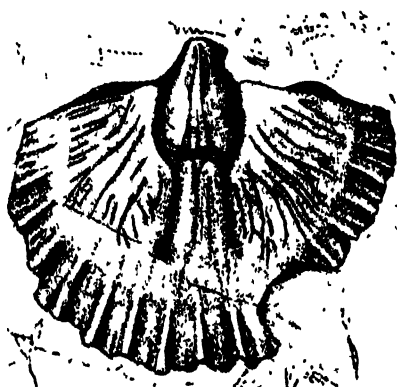
In the past *Dolerorthis psygma* has been at times recorded as *Orthis calligramma* Dalman, as in the case of a

* BU. = Figured Collection, Geological Museum, University of Birmingham.

well-preserved dorsal valve, BM.* B10056, in the British Museum (Natural History). From *Orthis* s.s. Schuchert and Cooper, 1931, however, to which *O. calligramma* belongs, the new species is distinguished since in it the dorsal valve is the more convex. On the same ground it is excluded from *Hesperorthis* Schuchert and Cooper, 1931, and *Schizoramma* Foerste, 1912.

"*Orthis*" *davidsoni* de Verneuil (1848, p. 341, pl. 4, fig. 9), in which the ventral valve is decidedly the more convex, is correctly referred to *Hesperorthis* by Schuchert and Cooper (1932, p. 86, pl. 4, figs. 22, 23, 24). The specimen from the Wenlock figured by Davidson (1869,

Text-fig. 1.

*Dolerorthis pygma*, sp. nov.

Old Storridge Common, near Alfrick. Cast of interior of ventral valve, showing narrow adductor and broad diductor insertions, also position of two main sub-parallel vascular trunks, and other radial vascular markings. BU 352 a. $\times 2$.

pl. xxxv. fig. 18) as *O. calligramma* var. *davidsoni* de Verneuil has, however, the two valves approaching oquiconvexity.

The specimens examined agree closely in internal characters with *Dolerorthis* Schuchert and Cooper, 1931 (1932, p. 88, pl. 5, figs. 10, 12, 15, 17-24), and may be referred to that genus since other genera have been excluded. The only European species that are placed in *Dolerorthis* by Schuchert and Cooper (1932, p. 89) are

* BM. = British Museum (Natural History), South Kensington.

Orthis rustica J. de C. Sowerby and *O. rustica* var. *osiliensis* Schrenck. They make no reference to the furrowed cardinal process in these, although Davidson described and figured it in the former (1869, p. 238, pl. xxiv. figs. 7, 22). Thus Schuchert and Cooper apparently treat this character as being of specific rather than of generic significance. In the two European species the exterior of the shell shows not only intercalated, but also bifurcating costæ that are altogether of lesser calibre than the strong and simple costæ in the new species. The same is true of *D. rustica* and its varieties figured by Reed (1917, pl. vi. figs. 3-19). The ventral muscular area of *D. psygma* agrees in pentagonal outline with that in Davidson's figures (1869, pl. xxxiv. fig. 16) of *D. rustica* and the one described by Reed (1917, p. 832).

Internal structure comparable with that of *D. psygma* is also seen in *D. reedi*, sp. nov. of the present paper. *D. reedi* has, however, much more numerous ribs. The median costæ of *D. reedi* bifurcate close to the umbo, whereas in *D. rustica* they seem rather to bifurcate at a distance of about 3 mm. from the umbo.

Schuchert and Cooper (1932, p. 89) ascribe to *Dolerorthis* three American species: *D. flabellites* (Foerste), *D. interplicata* (Foerste) and *D. nettelrothi* (Foerst). *D. interplicata* and *D. nettelrothi* both possess intercalated ribs (Foerste, 1909, p. 76, pl. 3, fig. 44).

D. psygma approaches most closely to the group of *D. flabellites* and its varieties. From *D. flabellites* as figured by Hall (1852, pp. 254-5, pl. 52, fig. 6) and Hall and Clarke (1892, pp. 192 and 227, pl. v. figs. 37-41 and pl. xx. fig. 1), it differs in having fewer ribs, only twenty as compared with thirty. Furrowing of the internal ribbing is not shown in Hall and Clarke's figures. In these figures, too, the ventral muscular area is shown as rounded.

In comparison with *D. flabellites* as figured and described by Foerste (1909, pp. 74-5, pl. iii. fig. 43) we see also that in *D. psygma* the ventral interarea cuts the plane separating the valves at a steeper angle, viz., 45° in *D. psygma* compared with 5° to 30° in those described by Foerste. Otherwise in dimensions, etc., the species are closely similar.

D. flabellites var. *spania* (Hall and Clarke) (1892-94, pl. lxxxiv. fig. 10) possesses fifteen ribs—less than in our

species, while the furrowing of the internal ribs is shown very strongly developed.

D. flabellites var. *fissiplicata* (Foerste) (1894, p. 573) is sharply distinguished from *D. psygma*, in possessing about seventy costæ. The ribbing of *D. flabellites* var. *dinorthis* (Foerste) (1894, p. 571, pl. xxxi. figs. 4-5) is finer than in *D. psygma*, although the convexity of the valves is about the same.

The number and character of the costæ in *D. psygma* are similar to those of *D. flabellites* var. *euorthis* (Foerste) (1894, p. 572, pl. xxv. figs. 12 a-b), but the convexity of the valves is reversed. *D. flabellites* var. *militaris* (Foerste) is similar to *D. flabellites* var. *euorthis* (Foerste). The figure referred to by Foerste (1885, pl. xiii. figs. 12a-12) in his description of *D. flabellites* var. *militaris* (Foerste, 1909, p. 75) is identical with that figured as *D. flabellites* var. *euorthis* (Foerste, 1894, pl. xxv. figs. 12 a-b).

Schuchert and Cooper (1932, pp. 88-89) use the greater convexity of the ventral valve in *Hesperorthis* to distinguish it from *Dolerorthis*, but refer *D. flabellites* var. *euorthis* to the latter genus. This of course raises the whole question of the separate validity of these two genera. Since material for comparison has not been available to the present authors, the definition as given by Schuchert and Cooper (1932, pp. 85-89) is followed.

Dolerorthis reedi, sp. nov.

(Pl. IV. figs. 1-2.)

1883. ? *Orthis rustica* T. Davidson, "Supplement to the British Silurian Brachiopoda," *Mon. Brit. Foss. Brach.* vol. v. p. 226.

1917. ? *Orthis (Plectorthis) rustica* var. *valsalliensis* F. R. C. Reed, "The Ordovician and Silurian Brachiopoda of the Girvan District," *Trans. R. Soc. Edinburgh*, vol. li. pt. iv. p. 834, pl. vi. fig. 20.

Syntypes. -BU. Geol. Dept. Museum, Fig. Coll. 353, 354.

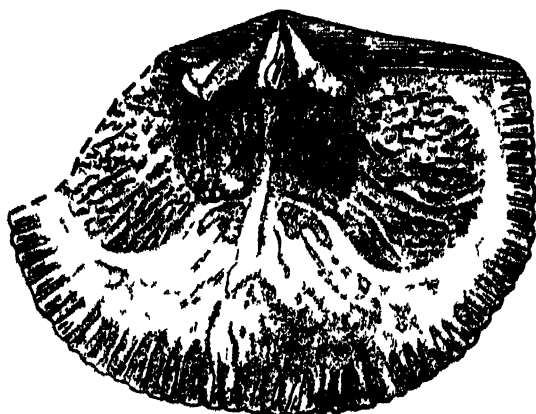
Horizon.—Upper Llandovery.

Locality.—Shaly limestone, side of burn, Penwhapple Glen, Penkill, Girvan.

Discussion.—A fuller description of *Dolerorthis reedi*, sp. nov. is deferred pending the discovery of the internal characters of the dorsal valve. *D. reedi* differs from

D. psygma in being more transverse, with breadth nearly one and a half times the length, the costæ are more numerous, the ventral muscular area is shorter—one third of the length of the valve as against two fifths of the length in *D. psygma*. The median ridge running forward from the anterior end of the narrow adductor track is also more clearly defined in *D. reedi*. In some of its characters *D. reedi* is nearer the Wenlock *D. rustica* (J. de C. Sowerby) from which, however, it is seen to differ in shorter muscular area, if we compare Pl. IV. fig. 2 of the present paper with

Text-fig. 2.



Dolerorthis rustica (J de C. Sowerby), Wenlock beds, Dudley. BU. 356.
Interior of dorsal valve, showing deep pits for adductor muscles and ovarian areas with radial ridges breaking down to a pustulate condition. $\times 2$.

Davidson's figure (1869, pl. xxxiv. fig. 16). There is also less backward flexion of costæ in the postero-lateral parts of the shell of *D. reedi*, a distinction which can be made out by comparing Pl. IV. fig. 1 with fig. 3, the latter showing a specimen from the Wenlock of Dudley, Worcestershire. There also seems to be some difference in the distances from the umbo at which branching of ribs takes place. Text-fig. 2 shows a gerontic dorsal interior of *D. rustica*, in which, as contrasted with Davidson's specimen (1869, pl. xxxiv. fig. 17), the ovarian markings are clearly

impressed. The transverse nature of this example is typical, though in beds of very pure Wenlock Limestone it should be noted that *D. rustica* may have length more closely approximating to breadth. For an explanation of the adaptation of transverse forms to more shaly environments see Lamont (1934 A-B, 1939). The radial interrupted vascular ridges in *D. reedi* (Pl. IV. fig. 2) are finer and more numerous than the more continuous ones in *D. psygma* and than the coarser and, in part, pustulate ones of *D. rustica*.

Family **Pectiorthidae** Schuchert and Cooper,
in Cooper, 1930.

Subfamily **PLATYSTROPHIINÆ** Schuchert and Le Vene, 1929.

Genus **PLATYSTROPHIA** King, 1850.

Platystrophia mimela, sp. nov.

(Greek μιμελή -- imitative.)

(Pl. IV. figs. 4-5; text-fig. 3.)

1917. ? *Orthis (Platystrophia) biforata* F. R. C. Reed. "The Ordovician and Silurian Brachiopoda of the Girvan District," *Trans. R. Soc. Edinburgh*, vol. li. pt. iv. p. 834 (*pars*) pl. viii, fig. 24.

Diagnosis. -Exterior: compact shell. Beaks broad-based projecting behind straight hinge-line. Ventral umbonal angle about 110°. Cardinal angles rounded, tending to rectangularity. Sinus in ventral valve almost one third of width: corresponding fold in anterior commissure not quite as deep as wide. Lateral commissures straight. Six to seven coarse costæ on each flank of the ventral valve, and three of like calibre, or slightly stronger and more angular, in the sinus. Dorsal fold with four costæ equal in strength to those on the flanks.

Ventral interior: marked umbonal cavity behind open delthyrium. Sub-rectangular diductor muscle-scars, separated by median ridge, and with strong striæ radiating from the beak and specially strong on the lateral margins. Scars sunken at back but bounded at front and sides by a ridge. External costation reproduced in interior.

Dorsal interior: crura divergent under incurved beak, inner surfaces wider apart towards ventral valve, uniting

under linear cardinal process which is continued forward in a short median ridge separating the adductor-scar areas.

Dimensions : —

Length	13 mm.
Breadth	14.5 mm.
Thickness	10 mm.

Holotype.—BU. Geol. Dept. Museum, Fig. Coll. 357 *a*, *b*, *c*.

Horizon.—Upper Llandovery.

Locality.—Sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm.

Discussion.—This species is founded on external and internal casts of a distinctive young adult.

It belongs to a type with comparatively few costations so that externally it imitates the other new species, *Camarotoechia transversaria* (Pl. VI. figs. 7–8) described below.

Text-fig. 3.



Platystrophia mimela, sp. nov. Coneygore Coppice, near Alfrick. BU. 357 *a*. Cast of interior of ventral valve, showing filling of delthyrial cavity and muscle scars sub-rectangular and radially ridged. $\times 2$.

Platystrophia biforata (Schlotheim) differs from *P. mimela* in having typically five costæ in the sinus and nine on each flank (Dietrich, 1922, p. 124). No doubt in sandy or clear water as opposed to shaly environments the number of costæ tends to be small, so that mere enumeration of the costæ may not be a criterion for distinguishing different species. Nevertheless, it seems desirable to have a separate name for this common Upper Llandovery form.

Other *Platystrophiæ* with a reduced number of costæ occur in the sandy Starfish Bed (Lamont, 1935, locality 7), of the Ashgillian at Girvan, as also in the fragmental and "knoll" limestones of Craighead Quarry, Girvan, and of the Chair of Kildare in Eire. At Craighead, some forms

with only five or six ribs on the flanks are noted by Reed (1917, p. 845).

The specimen figured by Reed (1917, pl. viii. fig. 24), from the Middle Llandovery at Woodland Point, Girvan, is regarded as belonging to the new species.

Platystrophia regularis Shaler, from the Ellis Bay formation, Anticosti Island, as figured by Twenhofel (1927, pl. xvi. figs. 19-20), has an outline very like ours, and also relatively reduced number of costæ, viz., two in sinus and about eight on the flanks. Twenhofel (p. 177), also reports it from two Silurian horizons, but possibly convergent evolution towards this simple type of *Platystrophia*, under certain environmental conditions, is the explanation, rather than a long persistence of the one species.

Platystrophia septentrionalis Poulsen (1943, pp. 12-13, pl. i. figs. 8-12), from the Ofley Island formation (Upper Llandovery) of North Greenland is even closer to *P. mimela*, though the latter is more equidimensional and has proportionately greater thickness. The costæ bounding the ventral sinus seem stronger in *P. septentrionalis* which also has at least nine costæ on each of the lateral slopes.

Superfamily **Dalmanellacea** Schuchert and Cooper, 1931.

Family **Dalmanellidæ** Opik, 1933, *non* Schuchert, 1929.

(=Wattsellidæ Schuchert and Cooper, 1931.)

Genus **MENDACELLA** Cooper, 1930.

Mendacella challinori Lamont.

(Pl. III. figs. 5-9.)

1940. *Mendacella challinori* A. Lamont " Derived Upper Llandovery Fossils in Bunter Pebbles, from near Cheadle, North Staffordshire," *Cement, Lime and Gravel*, vol. 15, pp. 26-28, fig. 2, Nos. 1-4.

Figured Specimens.--BU. Geol. Dept. Museum, Fig. Coll. 358-362.

Horizon.--Upper Llandovery (including Pentamerus Beds).

Localities.--Sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm; loose blocks, at Old Quarries (locality 3), 440 yards north of the Beek Reservoir, Old Storridge Common.

Discussion.—This species is well represented and even small, probably young, individuals show marked elongation of the ventral diductor scars (Pl. III. figs. 5–6), usually with strong vascular trunks. A cast of a young dorsal interior is also shown in Pl. III. fig. 9. This does not show the narrowing and elongation of the cardinal process as in most adults.

Suborder *PENTAMEROIDEA* Schuchert and Cooper, 1932.

Superfamily *Pentameracea* Schuchert, 1896.

Family *Stricklandiidae* Hall and Clarke, 1894.

Genus *STRICKLANDIA* Billings, 1859.

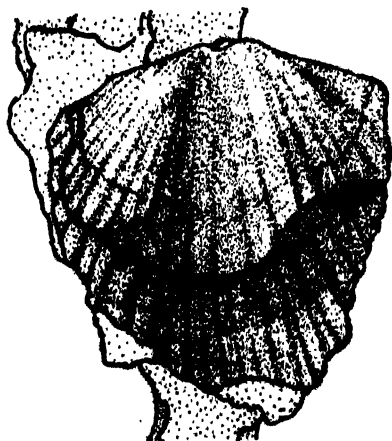
Stricklandia lirata (J. de C. Sowerby) var. nov. *diota*.
(Latin *diota* = two-eared.)

(Pl. IV. fig. 6; text-fig. 4.)

Holotype.—BU. Geol. Dept. Museum, Fig. Coll. 363.

Horizon.—Upper Llandovery (including Purple Shales).

Text-fig. 4.



Stricklandia lirata var. nov. *diota*. Coneygore Coppice, near Alfrick. BU. 364a. Cast of interior of ventral valve, showing sharp interruption of growth at about two-thirds the length, perhaps due to entry of sand into shell. This and an earlier growth-pause show the development of small "ears." $\times 2$.

Localities.—Walsall Co-operative Society Boring, at a depth of 1167–1175 feet; sunk track through Coneygore

Coppice (locality 1), 1200 yards east of Lower Tundridge Farm.

Discussion.—A form of *Stricklandia lirata* with the cardinal margin extended into "ears" has been observed at several Upper Llandovery localities, including Coneygore Coppice, Walsall, and Rubery. This adaptation has evident utility in excluding foreign material—an adaptation most frequently seen in the Strophomenacea (Lamont 1934 A–B) living in muddy surroundings. Though following L. J. Wills (1925, p. 73), he refers to specimens with small ears, J. K. S. St. Joseph (1935, p. 421) distinguishes only two varieties: *S. lirata* forma α and *S. lirata* forma β (= *S. lirata* var. *scotica* Reed). It seems desirable that the eared form should also have a name.

Forms with a reduced number of very coarse ribs should probably also be distinguished. They do not occur at Coneygore Coppice, but one from the Walsall Boring (Butler, 1937), from a depth of 948–953 feet, may be chosen as type (BU. 365), with the name *S. lirata* var. nov. *pacheia* (Greek *παχέα* = coarse).

Suborder *STROPHOMENOIDEA* Opik, 1934.

Superfamily *Strophomenacea* Schuchert, 1896.

Family *Plectambonitidae* Kozłowski, 1929.

Subfamily *LEPTESTIINÆ* Opik, 1933.

Genus *LEPTELLA* Hall and Clarke, 1892.

Leptella (*Merciella*) *vesper* subgen. et, sp. nov.

(Latin *Mercia* = Heptarchic kingdom of the English Midlands; *vesper* = evening, the west.)

(Pl. IV. figs. 7–12; text-fig. 5.)

Diagnosis.—Exterior: shell concavo-convex; parabolic outline; up to one and a half times as wide as long. Cardinal extremities rectangular or slightly produced to make a large acute angle. Ventral valve most swollen towards median line, with some lateral flattening. Ventral umbo rounded, projecting behind the hinge line about a tenth of the length of the shell, subtending an area bent back at about 30° from plane of valve; umbonal angle about 160°. Triangular delthyrium—posterior angle about 20°—closed for less than half its length by pseudodeltidium which projects above level of area. Dorsal valve flattened

for about two-thirds of its length, then gently bent upwards. Ornament of about eighteen stronger radii at anterior margin, not all reaching the umbo, numerous very fine threads in the interspaces, some concentric ornament especially towards hinge-line.

Ventral interior: cast of pedicle present. Teeth small, simple, with narrow extensions towards umbo and dental lamellæ joining on to ridge round muscle-scars. Muscular area one third of length of valve and two thirds as long as wide, surrounded by ridge which is emarginate in front. Diductors, each with three or four radial ridges, enclose between posterior halves subcircular adductor depression divided by median ridge. Pair of faint subparallel vascular trunks, usually seen arising from most anterior parts of diductor scars and interrupting the marginal ridge.

Text-fig. 5.



Leptella (Merriella) vesper, subgen. et sp. nov. (Oneygon Coppice, near Alfrick. BU. 372. Cast of interior of ventral valve, showing diductor scars enclosing adductors, and vascular trunks $\times 2$.

The interior may or may not show traces of the stronger external radii, but is always pustulate with specially strong pustules towards the sides and the apertural margin; up to three large pustules on a line normal to adjacent strong radii. Young specimens are strongly pustulate all over, also more transverse than adults.

Dorsal interior: cardinal process may bifurcate posteriorly. Crura run forwards and outwards and are then bent back to assume a semi-circular form, enclosing posteriorly small spoon-shaped sockets. Space between extremities of cruræ about two-sevenths width of valve, fronted by a narrower platform consisting of two swellings fused together, which is longer than wide and continues forward in a strong median septum dividing the diaphragm in two halves. The diaphragm extends anteriorly to from three to four fifths the length of the valve, is strongly emarginate in front of the septum, and has a frilled and

overhanging margin. The halves of the diaphragm are each slightly concave, and each side has up to five radial ribs which may bifurcate close to the frilled edge. Laterally the anterior margin of the diaphragm reaches almost to the cardinal extremities, where, however, it is less than half as high above the surface of the rest of the valve as in the anterior position. Anteriorly the shell bends back from the plane of the diaphragm, and may show traces of the external radii.

Dimensions : —

	Adults.	Young specimen.
Length	8-9 mm.	4 mm.
Breadth	10-14 mm.	6.5 mm.
Thickness (about) .	3 mm.	

Syntypes.—BU. Geol. Dept. Museum, Fig. Coll. 366-373.

Horizon.—Upper Llandovery.

Locality. Sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm.

Discussion and Definition of Subgenotype.—Ten internal casts of ventral valves were obtained which were at first doubtfully ascribed to *Leangella scissa*. Then two associated dorsal interiors put this identification quite out of the question.

The description of the exterior depends on two external casts of parts of a ventral and a dorsal valve, and one ventral valve (BU. 373), still showing part of the shell.

The genotype of *Leptella* is *L. sordida* (Billings), from the Quebec Group (Arenig) at Point Lévis (Hall and Clarke, 1892, p. 293, pl. xv. A, figs. 12-16). Among points of difference from *L. vesper*, it may be noted that *L. sordida* has a longer ventral area. Delthyrial characters are closely comparable, but in *L. sordida* the teeth are apparently unsupported by dental lamellæ. As *L. vesper* and *L. grayæ* (Davidson) have these structures they are tentatively ascribed to the subgenus *Merciella*, with *L. vesper* as the type.

Leptella (Merciella) grayæ, from the Balclutchie Group (Caradocian), Girvan (Reed, 1917, pp. 873-874, pl. xiii. figs. 10-13, 15-17, non fig. 14), has less specialization of the external ornament into coarse radii and very fine threads than *L. vesper*, and in the ventral musculo area the adductor

impressions cannot be distinguished from those of the diductors. In the dorsal interior, *L. grayæ* has a fairly straight crura, unlike *L. vesper*, but the incipient platform in front of the crura is the same in both. O. T. Jones (1928, pp. 40, 489-490) put *L. grayæ* by itself in a special group of his genus *Leptelloidea*, and Öpik (1933, p. 3) lets it remain as a *Leptelloidea* while remarking "in Wirklichkeit eher eine *Leptella* als eine *Leptelloidea* zu sein scheint." The double teeth and presence of lateral lobes on the ventral diductor muscle in *L. leptelloides* (H. Bekker), genotype of *Leptelloidea*, contrast with the simple condition in *Leptella*.

Leptella vesper also has a relatively simple arrangement of the ventral muscular area. Secondary simplification may be suspected in such a late form, but there are no criteria by which this can be demonstrated. The clear impression of the simple adductor and diductor scars is just what one expects in a late species, since in both ontogeny and phylogeny the muscles of brachiopods tend to leave deeper marks according to age and relative senescence.

The differences of *Leptella vesper* from *Leangella scissa*, typical interiors of dorsal valves of which have been figured from the Lower Llandovery (Jones, 1928, pl. xxv. figs. 10-11) and from the Middle Llandovery (Reed, 1917, pl. xiv. fig. 35), may be seen in the smaller size and generally more triangular shape of the latter, and in the fact that *L. scissa* has brachial lamellæ ("visceral disc" of Jones) in front of the cardinalia, in addition to the well-marked diaphragm which in both species has margins running towards the cardinal angles. In *L. scissa*, however, the diaphragm protrudes into a point instead of being emarginate in front. A more strongly mucronate condition of the anterior margin of the diaphragm is seen in *Leangella sholehookensis* (Jones), Slade Beds (Ashgillian), Lower Cresswell, Carmarthenshire.

The value of records of *Leangella scissa* from the Upper Llandovery, like those by Whittard (1932, table opposite p. 896), require re-investigation. It may not extend so high, though the related species *Leangella segmentum* (Lindström) is recorded by Jones as occurring from Upper Llandovery to Lower Ludlow.

Differences of *Leptella vesper* from *Leptestia musculosa* H. Bekker (1922, pp. 361-365) are found in the trifold cardinal process of the latter, and in its clearly defined pairs of anterior and posterior adductor scars in the dorsal valve. These scars lie on a platform which seems to be a parallel development with that in *L. grayæ* (cf. Reed, 1917, pl. xiii. fig. 16) and in *L. vesper*. An impression of such a platform can be seen in front of the crura in Pl. IV. figs. 10-11. In *Leptestia* also there are elliptical visceral fields on either side antero-laterally to the muscular area.

The function of the diaphragm in *L. vesper* may be the same as that of the brachial lamellæ in *Leangella*, viz., support for the "arms."

The cast of a faint ridge is seen running very close to the anterior margin of the dorsal valve (BU. 370) in Pl. IV. fig. 11, but not in the other dorsal valve figured.

Subfamily *PLECTAMBONITINÆ* Öpik, 1930.

Genus *PLECTODONTA* Kozłowski, 1929.

Plectodonta millinensis cf. var. *canastonensis* (O. T. Jones).

(Pl. IV. figs. 13-19.)

Dimensions :—

Length	6-9.25 mm.
Breadth	11-13 mm.
Thickness (about)	3 mm.

Figured Specimens.—BU. Gool. Dept. Museum, Fig. Coll. 374-380.

Horizon.—Upper Llandovery.

Locality.—Sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm.

Discussion.—More than eight specimens of a *Plectodonta* corresponding with *P. millinensis* var. *canastonensis* (Jones) have been examined.

Externally most of these seem to show relatively fewer strong radii in relation to fine threads than is the case in Jones's variety: a difference probably due to environment. The denticulation of the hinge-line characteristic of *Plectodonta* is seen close to the cardinal process in Pl. IV. figs. 15-16. The same specimen has a concentration of a few large pustules in the proximal part of the postero-lateral segment. Pl. IV. fig. 17 illustrates rugæ intersecting the hinge-line at a very low angle.

Family **Strophomenidae** King, 1846.

Subfamily **Rhynchonellinae** Schuchert, 1893.

Genus **Leptaena** Dalman, 1828.

Leptaena wisgoriensis, sp. nov.

(Latin *wisgoriensis* = one form of an adjective meaning "belonging to Worcester.")

(Pl. III. figs. 10-14; text-fig. 6, A & B.)

Diagnosis.—Exterior: shell concavo-convex, subsemi-circular to subquadrate, one and a half times as wide as long, maximum width at hinge-line. Ventral valve convex at all points. Umbo small, inconspicuous, carrying small open foramen, umbonal angle 160° or a little less, enclosing hinge-area which lies at an angle of 60° to the posterior part of the valve. Wide delthyrium, apical angle about 100° , with pseudodeltidium convex outwards. Shell sloping gently from umbo to cardinal angles, but strongly bent anteriorly through 90° , though without a sharply angular geniculation.

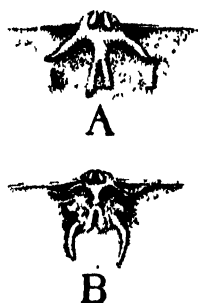
Dorsal valve in early development flat or gently convex, becoming slightly concave later, geniculate anteriorly. The disc is about eight ninths the total length of the shell. Length of fringe (measured in vertical direction) is up to one quarter of the total length, angle of geniculation from 80° to 90° . Hinge-line straight, cardinal extremities rounded or slightly produced, interarea long, narrow, bent back from plane of valve.

Ornamentation sixteen to twenty radiating costæ of which approximately ten reach the umbonal region, the others being intercalated in the main in front of half the length. Median costæ straight, lateral costæ slightly recurved. Each intercostal space contains up to ten radiating threads. The latter are crossed by numerous concentric rugæ, as many as twenty along the length of any one radius. The rugæ are interrupted by the strong radii, except in the lateral areas, where they are continuous although tending to be interrupted where crossing the costæ. In the lateral segments of the shell the rugæ make a small acute angle with the hinge-line, but when traced forward become concentric with the anterior edge of the disc. In the median segment of the disc the rugæ, here interrupted by the costæ, tend to assume a zig-zag pattern,

although often they are simply concentric but discontinuous.

Ventral interior: knob-like teeth are supported by strong dental plates the anterior sides of which converge in an angle of 100° . In front they are continued by ridges of lessening calibre to enclose a pentagonal or subcircular muscle-area. The latter is bisected by a strong, rounded median ridge which runs forward and emerges from the muscle-area between the ends of ridges bounding the diductor scars. The narrow adductor insertions appear on either side, between the ridge and the flabelliform diductors. Posteriorly the ridge widens to twice its normal thickness to give a callosity in front of which the pedicle entered.

Text-fig. 6.



Cardinalia of dorsal valve of *Leptæna wongoriensis*, sp. nov. Coneygore Coppice, near Alfrick. 3.

A. Specimen showing one pair of lateral ridges bounding areas where posterior branches of the adductors were attached. Plasticine cast of BU. 384.

B. Specimen with two pairs of lateral ridges, the anterior pair much longer but less elevated than those behind. Plasticine cast of BU. 383; see also Pl. III. fig. 13.

There is a third possibility of variation whereby no structures are seen except the crura and bilobed cardinal process: a condition approached, but not reached, in BU. 381 b (Pl. III. fig. 14).

Dorsal interior: notothyrial cavity shallow. Cardinal process small, bifid. Crural plates thin, enclosing posteriorly an angle of 120° , and curving outwards until they are nearly parallel to the hinge-line. Small oval notothyrial platform, continued in front into a short bifurcating ridge equal to about one third the length of the disc, separating a pair of posterior adductor scars. The latter

are bounded laterally by ridges, equal in length to one twelfth that of the shell, and with steep or overhanging sides directed away from the muscle-scars. The anterior adductors are closer together, twice as long as broad, and about three times longer than the posterior adductor scars. They may or may not be bounded at the sides by a distinct pair of ridges. When present such ridges are subparallel at first, but approach each other a little in the anterior third of their length. A broad rounded ridge occurs towards the antero-lateral edge of the disc, just inside the position of the angle of geniculation.

Dimensions.—

Length	7.6–10.5 mm.
Breadth	12.5–16 mm.
Thickness (about)	3 mm.

Syntypes.—BU. Geol. Dept. Museum, Fig. Coll. 381 *a–b*, 382 *a–b*, 383, 384.

Horizon.—Upper Llandovery (including *Pentamerus* Beds).

Localities.—Sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm; loose blocks, at Old Quarries (locality 3), 440 yards north of the Beck Reservoir, Old Storrige Common.

Discussion.—The state of preservation of the ornamentation varies, owing to coarseness of the matrix, but is very satisfactory in the case of Syntype BU. 381 *a*. In Syntype BU. 383 the two pairs of ridges bounding the muscle-scars are well developed and differentiated (text-fig. 6, B), but in some cases only the posterior pair (text-fig. 6, A), or none at all, are present. It is thought that the greatest development of the ridges occurs in specimens in the beds with *Pentamerus lævis*, while especially those with incompletely developed ridges occur in the assemblage which includes *Stricklandia lirata* and its varieties.

Leptæna wisgoriensis bears a slight resemblance to *Leptæna loveni* de Verneuil (1848, p. 339), but differs in having a greater number of radiating costæ, about twenty as against seven. Judging from de Verneuil's description the rugæ are more regularly arranged in his species, in spite of irregularly projecting laminae. In his figure (pl. iv. fig. 5), which is taken from an aged individual, he

shows a strong anterior fold in the fringe. A tendency to such folding appears in one of our specimens (Pl. III. fig. 11), but such folds are common in *L. rhomboidalis* (Wilckens) and probably have no specific significance. Such notches develop in many genera in a position corresponding with the exhalent opening between the lobes of the mantle as has been explained already (Lamont, 1934 A, p. 217, figs. 15, 16, etc.) in dealing with *Kjerulfina polycyma* Bancroft, from a high Caradocian horizon in Shropshire, and a notched form of *Strophonella euglypha* (Hisinger) from a muddy facies of the Aymestry Limestone. The type specimen of the latter, *S. euglypha* var. *alveata* Lamont (1934 A, p. 217, fig. 15), is in the Hunterian Museum at Glasgow University (HM L 1502).

Leptaena wisgoriensis bears a considerable likeness to *L. julia* (Billings) (Twenhofel, 1927, p. 184, pl. xxii. figs. 1-2), but in *L. julia* there is sharper geniculation of the ventral valve and marked auriculation of the cardinal extremities. *L. julia* occurs on about the same horizon as the English form, i. e., in the Jupiter formation which is roughly equivalent to the Upper Llandovery (Twenhofel, 1927, p. 80).

The ornament of the new species also suggests comparison with that of the Bohemian *Leptaena stephani* Barrande (1847, pl. xx. fig. 7), which is, however, much more transverse and alate, and deeply concavo-convex.

Leptaena? sp. Poulsen (1943, p. 21, pl. 2, fig. 2), from the Ofley Island formation (Upper Llandovery) of North Greenland, has also similar ornament, but the interior is unknown. Poulsen compares the ornament in an Ordovician form *Rafinesquina*? Hortedahl (1916, pl. iii. fig. 6) from Ringerike, near Oslo. Neither of these examples shows such pronounced outward diversion of postero-lateral rugæ as in *L. wisgoriensis*.

The small platform at the posterior end of the ventral muscular area is of a type which has been described by Hall and Clarke (1892, vol. i. p. 277) as a "pedicle-scar." Winchell and Schuchert (1895, p. 422) described a comparable structure in *Orthis* as the place of insertion of a pedicle muscle, and this opinion is repeated in Schuchert and Cooper (1932, p. 23). Meantime Kozłowski (1929, p. 91, fig. 25) had described a structure at the posterior end of the swollen median septum in *Leptaena emarginata*

(Barrande) as the impression of a poduncular ligament. M. A. Arber (1939, p. 88, fig. 3) has shown how such a structure may arise in specimens like *L. analoga* Phillips, where the foramen is plugged, as a result of reduction of the pseudodeltidium. She terms such a callosity a "secondary pseudodeltidium" and thinks of it as occurring where the pedicle has been lost at an early stage or has migrated in a forward direction away from the hinge-region. A cast of a normal pseudodeltidium appears, however, to be present in *L. wisgoriensis* in the usual position, so that in this case the callus may be a point of attachment of a muscle in connection with the pedicle, which seems to join on to the rear of the platform in Syntype BU. 382 a-b.

Genus BRACHYPRION Shaler, 1865.

Brachyprion arenaceus (Salter MS.), forma typica
(Pl. V. figs. 1-10; Pl. VII. figs. 1 and 4.)

- 1865. *Strophomena arenacea* J. W. Salter (? pars), *Catalogue of the Museum of Practical Geology*, p. 36.
- 1865. *Strophomena arenacea* J. W. Salter (pars), "Appendix on the Fossils," in "The Geology of North Wales," *Mem. Geol. Surv. Gt. Britain*, vol. iii. p. 361.
- 1871. *Strophomena arenacea* T. Davidson (pars), *Mon. Brit. Foss. Brachiopoda*, vol. iii. pp. 296-297, pl. xlii. fig. 6, non figs. 7-8.
- 1873. *Strophomena arenacea* J. W. Salter, *Catalogue of Cambrian and Silurian Fossils in the Geological Museum, Cambridge*, p. 88.
- 1880. *Strophomena arenacea* J. W. Salter and R. Etheridge (pars), "Appendix on the Fossils," in "The Geology of North Wales," *Mem. Geol. Surv. Gt. Britain*, vol. iii. (second edition), p. 436.
- 1883. *Strophomena arenacea* T. Davidson (? pars), *Mon. Brit. Foss. Brach.* vol. v., *Silurian Supplement*, p. 197, pl. xvi. ? figs. 2, 3, 5, non fig. 4.
- 1917. *Stropheodonta arenacea* F. R. C. Reed (? pars), "Ordovician and Silurian Brachiopoda of the Girvan District," *Trans. R. Soc. Edinburgh*, vol. li, p. 891, non pl. xvi. fig. 19.

Diagnosis.—Exterior: shell concavo-convex, greatest width at hinge-line or just in front of it. Length usually about two thirds of width, but the two measurements are sometimes approximately equal. Convexity varies greatly from very gentle, in cases where the direction of growth of the ventral valve changes through an angle of about 50°, to those where the change is through 100° or even 110°, so that the anterior part of the ventral valve may be at 90° to the plane of the posterior part, or they may even enclose an acute angle of 80° or less. The umbo is not prominent,

and in front of it there is only a slight tumescence. Umbonal angle about 170° . Hinge-area narrow, approximately in the same plane as the valve, or only slightly bent back from it. Delthyrium narrow, sides almost parallel. Ornament of numerous radii which characteristically converge and diverge slightly and may be separated by up to about four threads and still finer concentric markings. Increase of radii and threads by intercalation, and some threads die out or anastomose distally.

Ventral interior: in less convex examples, flabellate diductor impressions extend to half the length, but in those showing strong convexity they do not extend in front of the main bend in the shell. The posterior margins of the scars converge at an angle of 90° , and anteriorly their outline is that of a half circle. A median ridge is present which may or may not run forward beyond the muscular area. Situated posteriorly on either side of the ridge are ill-defined oval adductors, behind which the median ridge broadens into a small platform which sometimes has a central depression. Teeth completely fused to the hinge-margin have about twelve denticulations on each side, extending to from a third to two-fifths of the width. Traces of radii are seen on the inside of the valve, which is finely pustulate. Stronger pustules outside the postero-lateral margin of the muscle-area may be ovarian.

Dorsal interior: the inner surface is gently convex or may vary towards a flat condition. Straight hinge-line is interrupted only by a cardinal process, about a quarter of the length of which extends behind the hinge-line. Cardinal process consists of two strong lobes, each furrowed on posterior side. Weak crura diverge from hinge-line at about 20° , behind which the hinge line is finely denticulate. A platform in the form of an elongate "Y" occurs in front of the crura, but may be only very weakly developed. On either side of this the adductors were attached, and outside these lie two radial ridges of varying strength. In front of the muscular area there may be a short median ridge, partly surrounded by a patch of pustules, while two larger pustulate areas appear in the postero-lateral segments.

Dimensions :—

Length	.. 11	12	13.5	14.5	17.5	20.5 mm.
Width	.. 18	18.5	19	17.5	25	20.5 mm.
Thickness	..	2.5–10	mm.			

Lectosyntypes.—SMC. A 16219, A 16220 *a-b*.

Neosyntypes.—BU. Geol. Dept. Museum, Fig. Coll. 385-388, 390-392.

Horizon.—Upper Llandovery.

Locality.—Sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm.

Discussion.—Abundant material was obtained from Old Storridge Common, in the neighbourhood of Gunwick disused paper mill, the locality from which one of Salter's variant specimens described below as *Brachyprion arenaceus* var. nov. *lobatus* (GSM. 11461: Pl. VII. fig. 2 and Davidson, 1871, pl. xlii. fig. 7) was obtained. Variation in convexity and musculature has been studied, and the dorsal valve is now described for the first time. The concave dorsal valve (BU. 390: Pl. V. fig. 9; and an unfigured specimen BU. 392) are regarded as more characteristic than a flattened form (BU. 389: Pl. V. fig. 8) which was picked up loose in Pentamerus Beds material 440 yards north of Beck Reservoir and which may belong to *B. arenaceus* var. nov. *geniculatus*.

Forms of ventral valve (Pl. V. fig. 5, and Pl. VI. fig. 1) transitional to the new varieties *Brachyprion arenaceus* var. *lobatus* and var. *geniculatus* are also figured. Only one undoubted example (BU. 394: Pl. VI. fig. 2) of *B. arenaceus* var. nov. *geniculatus* was actually found in the calcareous silts of Coneygore Coppice (locality 1).

Affinities.—*Brachyprion anticostiensis* Schaler, from the Jupiter formation (Lower Niagaran) of Anticosti Island, bears some resemblance to ours in having the same platform in front of the cruræ in the dorsal valve and a similar distribution of pustulate areas (Twenhofel, 1927, pl. xxii. fig. 16). Differences lie in the flat form of the American shell and in the bending back of the radial ornament towards the hinge-line. Such retroflexion of the radii may be characteristic where evolution is from convex to flattened. Other distinguishing characters of *B. anticostiensis* are that it has denticulation of the hinge-margin extending for about half the distance towards the cardinal angles, and its ventral muscle scars are very faintly impressed.

There is also a comparison with *Brachyprion* cf. *philomela* (Billings) as figured by Curt Teichert (1937, pl. xi. fig. 13, pl. xii. figs. 5 and 6) from the Niagaran of

Kûk in Southampton Island, north of Hudson Bay, though in these up to seven threads occur between the stronger radii. One specimen (fig. 5) is slightly alate, but Teichert's other figured specimen has an outline very like that in our Pl. V. fig. 10, and the "waviness" of the radii and threads is the same. Specimens from the Upper Llandovery near Oslo, ascribed by Høltedahl to *B. philomela* are alate (1914, pl. v. figs. 1 to 3), a characteristic not usual in *B. arenaceus* or its varieties.

Brachyprion subinterstitialis Kozłowski (1929, pp. 96-99, figs. 28-29, pl. iv. figs. 1-7 a), from the Borszczow and Lower Czortkow stages of Poland, roughly equal to the English Ludlow, has comparable ornament and internal structure. Two differences are the deeper posterior adductor scars in the dorsal valve and the much larger number of denticulations on the hinge-line—up to about twenty-two as against about twelve in *B. arenaceus*. Such differences would be consistent with the descent of *B. interstitialis* from the British Upper Llandovery form. It is interesting, too, that *B. interstitialis*, var. *seretensis* Kozłowski from the same beds shows increase in the number of threads and relative reduction in the number of stronger radii, and develops geniculation, in much the same way as our *B. arenaceus*, var. nov. *geniculatus*.

Davidson was the first author to figure *Brachyprion arenaceus* (1871, pl. xlii. figs. 6-8), but unfortunately at least two of the specimens of Salter's which he figured (GSM. 11460, 11461) require to be distinguished as varieties. Salter in 1873 clarified his meaning by applying the name "*Stropheodonta arenaceu*" to a number of shells in the Geological Museum at Cambridge University (SMC. A 16208-16221). From among these shells which were named by Salter, have been chosen the lectosyntypes on which, along with neosyntypes, the present diagnosis of *B. arenaceus* forma typica is based.

Brachyprion arenaceus (Salter MS.) var. nov. *lobatus*.
(Pl. VI. fig. 6; Pl. VII. fig. 2.)

1865. *Strophomena arenacea* J. W. Salter (*pars*), *Catalogue of the Museum of Practical Geology*, p. 36.

1865. *Strophomena arenacea* J. W. Salter (*pars*), "Appendix on the Fossils" in "The Geology of North Wales," *Mem. Geol. Surv. Gt. Britain*, vol. iii. p. 361.

1871. *Strophomena arenacea* T. Davidson (*pars*), *Mon. Brit. Foss. Brachopoda*, vol. iii. pp. 296-297, pl. xlii. figs 7, 6 (?), non 8.
1880. *Strophomena arenacea* J. W. Salter and R. Etheridge (*pars*), "Appendix on the Fossils" in 'The Geology of North Wales,' *Mem. Geol. Surv. Gt. Britain* vol. iii. (second edition), p. 436.

Diagnosis.—This variety includes individuals with a strong ridge around the ventral muscle-scars. Diductor scars may diverge anteriorly in a cravat-like fashion (*cf.* Pl. VI. fig. 6), or they may be parallel with the boundary ridge only slightly emarginate in front.

Dimensions :—

	Form in Pentamerus Beds (GSM 11461).	Form in Purple Shales (BU. 397).
Length	27 mm.	31.7 mm.
Width	27 mm.	37.4 mm.
Thickness (about)	10 mm.	6 mm.

Syntypes.—BU. 397, GSM. 11461.

Horizon.—Upper Llandovery (Pentamerus Beds and Purple Shales).

Localities. Gunwick Mill, near Alfrick, Worcestershire (see Davidson, 1871), Walsall Co-operative Society boring, Division O, 1029-1034 feet down, Walsall, South Staffordshire (see Butler, 1937).

Discussion.—This variety may also occur occasionally in the sunk track through Coneygore Coppice (locality 1), but appears to be more characteristic in beds with *Pentamerus lævis* like those at Gunwick Mill, from which Davidson's figured specimen (GSM. 11461: Davidson, 1871, pl. xlii. fig. 7) was obtained. A photograph of Davidson's ventral valve is reproduced in Pl. V. fig. 2 of the present paper, and it will be seen that the median septum traversing the anterior part of the muscle-area turns towards the right, so that Davidson has given us a reversed picture. As well as *P. lævis*, *Favosites cf. asper* d'Orbigny and *Streptelasma* sp. occur along with the Gunwick Mill specimen of *Brachyprion arenaceus*, var. nov. *lobatus*.

As we would expect, the Purple Shales provide a somewhat more transverse form of the new variety, but in no example of *Brachyprion arenaceus* var. nov. *lobatus* have we observed concave margins to the adductor muscles, such as are seen in forms of *B. arenaceus* var. nov. *geniculatus* (Pl. VI. fig. 5) from the Purple Shales facies.

The specimen in Pl. VI. fig. 1, from *Pentamerus laevis* beds, differs from *Brachyprion arenaceus* var. nov. *lobatus* only by its marked geniculation.

Brachyprion arenaceus (Salter MS.) var. nov. *geniculatus*.
(Pl. VI. figs. 1 (transitional form) and 2, 3 (?), 4 to 5 ;
Pl. VII. fig. 3.)

1865. *Strophomena arenacea* J. W. Salter (*pars*), *Catalogue of the Museum of Practical Geology*, p. 36.
1866. *Strophomena arenacea* J. W. Salter (*pars*), "Appendix on the Fossils" in "The Geology of North Wales," *Mem. Geol. Surv. Gt. Britain*, vol. iii. p. 361.
1871. *Strophomena arenaceu* T. Davidson (*pars*), *Mon. Brit. Foss. Brachiopoda*, vol. iii. pp. 296-297, pl. xlii. fig. 8, non 6-7.
1880. *Strophomena arenacea* J. W. Salter and R. Etheridge (*pars*), "Appendix on the Fossils" in "The Geology of North Wales," *Mem. Geol. Surv. Gt. Britain*, vol. iii. (second edition), p. 436.
1883. *Strophomena arenacea* T. Davidson (*pars*), *Mon. Brit. Foss. Brachiopoda*, vol. v. *Silurian Supplement*, p. 197, Pl. xvi. fig. 4 (?).
1917. *Stropheodonta arenacea* F. R. C. Reed (*pars*), "Ordovician and Silurian Brachiopoda of the Girvan District," *Trans. R. Soc. Edinburgh*, vol. li. p. 891, pl. xvi. fig. 19 (?).

Diagnosis.—This variety includes shells with marked geniculation and a pronounced ridge around the ventral diductors. There is greater or less divergence of diductor scars in front, and the lateral margins of these may be convex (*cf.* Pl. VI. fig. 1), nearly parallel (*cf.* Pl. VI. fig. 4), or concave (*cf.* Pl. VI. fig. 5).

Dimensions :—

	Form in Pentamerus Beds (BU. 393).	Form in Purple Shales (BU. 396).
Length	15.3 mm.	34 mm.
Width	21 mm.	41 mm.
Thickness (about) ...	7 mm.	5 mm.

Syntypes.—GSM. 11460, BU. 394, 395, 396.

Horizon.—Upper Llandovery (Transitional form BU. 393 in *Pentamerus* Beds ; typical form in Purple Shales).

Localities.—Sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm ; silicified Rubery sandstone (Division 115 of Wills, Wilkins and Hubbard, 1925), Rubery, near Birmingham ; Walsall Co-operative Society boring (Division O of Butler, 1937), 1070-1075 feet down, Walsall, South Staffordshire : also Huntley Hill (Davidson, 1871, pl. xlii. fig. 8).

Discussion.—There is a tendency for a larger number of fine threads to appear between the radii than in *Brachyprion arenaceus* forma typica, at least in the specimens from the Purple Shales facies. This may be in correlation with the muddier environment (cf. Lamont, 1934 A, pp. 216, 217, 218; 1934 B, pp. 180–182).

Brachyprion sp.
(Pl. VII. figs. 5–6.)

Dimensions :—

Length	6 mm.
Width	10 mm.

Figured specimen.—BU. 398 a.

Horizon.—Upper Llandovery.

Locality.—Sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, near Alfrick.

Discussion.—The rugæ recall those in *Stropheodonta* (*Leptostrophia*) *filosa* (J. de C. Sowerby) var. *mullochiensis* Reed, but occur relatively further forward. Radial ornament is not preserved. Another possibility is that this is a rugate relative of *Stropheodonta compressa* (J. de C. Sowerby).

Order TELOTREMATA Beecher, 1891.

Superfamily **Rhynchonellacea** Schuchert, 1896.

Family **Camarotoechiidae** Schuchert and Le Vene, 1929.

Subfamily **REYNCHOTREMATINÆ** Schuchert, 1896.

(Genus **STEGERRHYNCHUS** Foerste, 1909.

Stegerhynchus (?) cf. *weaveri* (Salter MS.).

(Pl. VII. figs. 7–10; text-fig. 7, A & B.)

Dimensions :—

Length	7 mm.–9.5 mm.
Width	6.5 mm.–9.5 mm.

Figured Material.—BU. 403 a–b, 404, 405.

Horizon.—Upper Llandovery (Pentamerus Beds).

Locality.—Loose blocks, at Old Quarries (locality 3), 440 yards north of the Beck Reservoir, Old Storridge Common.

Discussion.—The specimens under consideration seem to permit of a fuller description of *Rhynchonella weaveri* Salter MS. than was possible when Davidson figured the exterior only (1869, pl. xxiv. figs. 14 and 14 a). Fold and sinus have almost disappeared in our shells, though the four or five median plications are decidedly stronger than the others, of which about twenty-four are present on each valve. Presence of the linear ridge in the crural cavity, if it is, as it seems, a true cardinal process, excludes the species from the *Camarotoechiinae* as defined by Schuchert and Le Vene (1929).

Text-fig. 7.



Stegerhynchus (?) cf. *weaveri* (Salter MS.). $\times 2$ (approx.).

- A. Internal cast of ventral valve. Delthyrial cavity has longitudinal depression for attachment (?) of pedicle, and is divided by a transverse ridge from the muscle-area. Note narrow anteriorly divergent dental plates. BU. 403 b, same as Pl. VII. fig. 8.
- B. Internal cast of dorsal valve, with impression of strong median septum bifurcating posteriorly to support a hinge-plate which carries two outwardly diverging projections on each side of an oval (crural) cavity containing a narrow elongate ridge representing a cardinal process. BU. 404, same as Pl. VII. fig. 9.

The more elongate form was used by Davidson (1869, p. 185) to distinguish *Rhynchonella weaveri* from *R. llandoveryana*, but he thought they might be varieties of the one species. Our *S.* cf. *weaveri* is also more elongate than Salter's *Camarotoechia obtusiplicata* which Davidson (1869, pl. xxiv. fig. 7) lumps with *C. nucula* (J. de C. Sowerby). One can only comment that much more material is needed for a fuller understanding of the *Camarotoechiæ* and related genera so common in the Upper Llandovery sandstones.

The transverse ridge separating the delthyrial cavity from the diductor-muscle depressions is fainter in the young individual (BU. 405; Pl. VII. fig. 10) but clearly

defined. It reminds one of Winchell and Schuchert's figure (1895, pl. xxxiv. fig. 34) of the ventral interior of *Rhynchotrema capax* (Conrad). A similar transverse septum is seen in Hall and Clarke's figure (1893, pl. 59, fig. 49) of the Devonian *Camarotoechia contracta* Hall.

In the adult ventral interior (BU. 403 b; Pl. VII. fig. 8 and text-fig. 7, A) the dental lamellae are seen to diverge.

Species previously assigned to *Stegerhynchus* by A. F. Foerste (1909, pp. 96-97, pl. iii. figs. 47 A, B, C, 48 A, B, C) include *S. neglecta* (Hall, 1852) and *S. whitii* (Hall, 1863), and he founded varieties of these on specimens from the Clinton bed, Clifton, Tennessee, at a horizon probably not very different from that of *S. (?) cf. weaveri*.

Regarding the interior of the dorsal valve of *Stegerhynchus*, Foerste (p. 96) writes: "While the other plications on the interior of the valve become indistinct before reaching the crural plates, the median plication is strengthened by a thickening of the shell posteriorly and forms a median elevation which broadens slightly on reaching the anterior margin of the crural plates. The crural plates present a slightly concave surface approximately parallel to the plane of the valve, and project forward at their inner angles so as to form crural tips. The shell beneath the crural plates is thickened and filled out so that only a narrow space is left between these plates, and this space is occupied by a very narrow, linear septum, representing the cardinal process."

When Foerste (1909, p. 97) refers to *S. whitii* var. *præcursor* as *Rhynchotrema*, he is apparently thinking of the allied, mainly Ordovician, genus *Rhynchotrema*.

Subfamily CAMAROTÆCHINÆ Schuchert and Le Vene, 1929

Genus CAMAROTÆCHIA Hall and Clarke, 1893.

Camarotæchia transversaria, sp. nov.

(Latin *transversarius* = wider than long.)

(Pl. VI. figs. 7-8.)

Dimensions:

Length	10 mm.
Width	12 mm.

Holotype.—BU. 401.

Horizon.—Upper Llandovery.

Locality.—Sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, near Alfrick.

Discussion.—A full description is postponed till more material is available, but the depth of the sinus in the ventral valve and the simplicity, straightness, and small number of the plications (in which respects the new species is almost a homeomorph of *Platystrophia mimela*, sp. nov.) distinguish this species from most other Upper Llandovery *Camarotoechiæ*. Another feature is the small, rounded pair of adductor impressions sunk well below the level of the oblong diductor scars. These are well seen in BU. 402 (Pl. VI. fig. 8), and are also present, though more faintly, in the holotype (BU. 401).

From the internal cast it may be suggested that the ventral sinus does not begin until well in front of the beak.

A close comparison is probably that with *Camarotoechia fringilla* (Billings) from zone 2 of the Gun River formation in Anticosti Island (Twenhofel, 1927, pl. xxi. fig. 7), but in the American species there is more pronounced retroflexion of the plications which lie outside the ventral sinus. *C. fringilla* also occurs in the Bescie under the Gun River, but does not range upwards into the Jupiter formation. The Bescie is Lower Llandovery, and the Jupiter is definitely Upper Llandovery, so that the range of *C. fringilla* differs from that of *C. transversaria*.

Camarotoechia transversaria is also very like *C. sp.* Teichert (1937, p. 141, pl. xii. figs. 7-9), from the Niagaran at Kûk, Southampton Island, north of Hudson Bay, which he regards as possibly intermediate between *C. neglecta* (Hall, 1852, vol. ii. p. 70, pl. 23, figs. 4 a-e) from the Waldron Shale of Indiana, which is less transverse than *C. transversaria* and has only five ribs on each side of the sinus, and *C. winiskensis* Whiteaves (1906, p. 272).

Camarotoechia numerosa, sp. nov.

(Latin *numerosus* = many.)

(Pl. VII. fig. 11.)

Dimensions :

Length.....	over 5 mm.	10.5 mm.
Width	7 mm.	10.5 mm.

Syntypes.—399 a-b, 400.

Horizon.—Upper Llandovery (including Pentamerus Beds).

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Localities.—Sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm; loose blocks at Old Quarries (locality 3), 440 yards north of the Beck Reservoir, Old Storridge Common.

Discussion.—A full description is delayed until more specimens are available, of what appears to be a relatively rare form. The large number of plications justifies the new specific name, though Davidson (1883, pl. x. fig. 32) figures a specimen with a like number of plications as *Camarotoechia llandoveryana*. The very small dorsal valve (BU. 400), taken as belonging to the new species, has about thirty-six ribs though the shell is scarcely 7 mm. wide.

Superfamily **Spiriferacea** Waagen, 1883.

Family **Spiriferidae** King, 1846 (*emend.* Davidson, 1884).

Subfamily **TRIGONOTRETINÆ** Schuchert, 1893

Genus **SPIRIFER** Sowerby, 1815.

Subgenus **CRISPPELLA** Kozłowski, 1929.

Spirifer (*Crispella*) *anglica*, sp. nov.

(*Latin Anglicus* = English.)

(Pl. VII. fig. 12.)

Dimensions :—

Length	10 mm.
Width	14 mm.

Syntypes.—BU. 406 a-b, 407, 408.

Horizon.—Upper Llandovery (Pentamerus Beds).

Localities.—Loose blocks, 440 yards north of the Beck Reservoir, at Old Quarries (locality 3), Old Storridge Common; also in Middle Bunter pebbles of Sling Common, near Romsley, Worcestershire.

Discussion.—This species is much larger than *Spirifer* (*Crispella*) *crispa* (Hisinger) well known in the Wenlock (Davidson, 1866, pl. x. figs. 14-15). Upper Llandovery specimens referable to *Crispella anglica*, sp. nov., have also been observed in derived pebbles of coarse pinkish and buff sandstone with the following fauna :—

Favosites cf. *asper* d'Orbigny.

Streptelasma sp.

Brachyprion arenaceus (Salter MS.) forma typica,

Dolerorthis psygma, sp. nov.

Mendacella challinori Lamont.

Meristella (?) sp.

Pentamerus laevis (J. Sowerby).

Holopella (?) *cancellata* (J. de C. Sowerby).

Encrinurus cf. *mullochiensis* Reed.

Size is, from one point of view, dependent on the amount of oxygen available, and this would usually be greater in a sandy than in a muddy environment (Lamont, 1934 A and B). In this connection, we remark that James Hall (1852, pp. 262-263) records very small *Crispella crispata* from shales at Lockport in the Niagara Group. Later, he reports (1879, p. 157) larger examples from the same formation in Indiana. Some of the difference between the Upper Llandovery and Wenlock *Crispellæ* is doubtless due to this factor, but modern palæontological usage is best served by creating a new species for the Upper Llandovery specimens. It is hoped to give a full description later *vis-à-vis* another imperfectly known, but apparently closely comparable form, 'C. sp. Poulsen (1943, pp. 55-56, pl. vi. figs. 13-20) from the Offley Island formation (Upper Llandovery) on the coast of Kennedy Channel, south-west of Cape Bryan, North Greenland.

Poulsen (1943, p. 111) puts *Crispella* and *Delthyris* as separate genera in the subfamily Delthyrinæ Waagen, 1883. *Crispella* differs from *Delthyris* in having no well-developed median septum dividing the ventral muscle-area into right and left halves.

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EXPLANATION OF PLATES.

PLATE III.

- Fig. 1.* BU. 350 a. *Dolerorthis pygma*, sp. nov. Plasticine cast of syntype. Exterior of dorsal valve. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, Old Storridge Common, near Alfrick, Worcestershire. $\times 2$.
- Fig. 2.* BU. 350 b. Ditto. Internal cast of dorsal valve. Same horizon and locality. $\times 2$.
- Fig. 3.* BU. 351. Ditto. Internal cast of ventral valve. Same horizon and locality. $\times 2$.
- Fig. 4.* BU. 350 b. Ditto. Plasticine cast of syntype. Interior of dorsal valve. Same horizon and locality. $\times 2$ (approx.).
- Fig. 5.* BU. 358. *Menducella challinori* Lamont. Internal cast of ventral valve of young individual showing elongate diductor scars and vascular trunks. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, Old Storridge Common, near Alfrick, Worcestershire. $\times 3$.
- Fig. 6.* BU. 359. Ditto. Same horizon and locality. $\times 3$.
- Fig. 7.* BU. 360. Ditto. Adult. Same horizon and locality. $\times 2$.
- Fig. 8.* BU. 361. Ditto. Same horizon and locality. $\times 2$.
- Fig. 9.* BU. 362. Ditto. Internal cast of dorsal valve of young individual. Same horizon and locality. $\times 3$.
- Fig. 10.* BU. 381 a. *Leptaena wigfortensis*, sp. nov. Plasticine cast of syntype. Exterior of dorsal valve. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, Old Storridge Common, near Alfrick, Worcestershire. $\times 4$.
- Fig. 11.* BU. 382 a. Ditto. Plasticine cast of syntype. Exterior of ventral valve with open foramen. Same horizon and locality. $\times 2$.
- Fig. 12.* BU. 382 b. Ditto. Internal cast of ventral valve, with part of shell adhering (top right). Note impression of median septum which ends posteriorly in cast of delthyrial callus. Same horizon and locality. $\times 2$.
- Fig. 13.* BU. 383. Ditto. Internal cast of dorsal valve of fully adult individual. (Antero-lateral margin damaged since being photographed.) Upper Llandovery (Pentamerus Beds), Old Quarries (locality 3) on south side of Old Storridge Common, 440 yards north of the Beck Reservoir. $\times 2$.
- Fig. 14.* BU. 381 b. Ditto. Internal cast of weakly developed dorsal valve, with ornament showing through from exterior. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, Old Storridge Common, near Alfrick, Worcestershire. $\times 2$.

PLATE IV.

- Fig. 1.* BU. 353. *Dolerorthis reedi*, sp. nov. Plasticine cast of syntype. External costation. Upper Llandovery calcareous silt. Gorge section, Penkill, near Girvan, Scotland. $\times 2$.

- Fig. 2.** BU. 354. Ditto. Internal cast of ventral valve. Same horizon and locality. $\times 2$.
- Fig. 3.** BU. 355. *Dolerorthia rustica* (J. de C. Sowerby). Exterior of ventral valve. Most of the median costæ bifurcate at about 3 mm. from the umbo. (See also text-fig. 2.) They bifurcate less close to the umbo than those in *D. reedi*, sp. nov. Dudley (Wenlock) Limestone, Dudley, Worcestershire. $\times 2$.
- Fig. 4.** BU. 357 a. *Platystrophia mimela*, sp. nov. Internal cast of ventral valve. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, Old Storridge Common, near Alfrick, Worcestershire. $\times 2$.
- Fig. 5.** BU. 357 b. Ditto. Plasticine cast from holotype. Exterior of ventral valve. Same horizon and locality. $\times 2$.
- Fig. 6.** BU. 363. *Stricklandia lirata* (J. de C. Sowerby) var. nov. *diota*. Exterior of ventral valve. Upper Llandovery Purple Shales, Walsall Boring, Division V, at a depth of 1167–1175 feet. $\times 1\frac{1}{2}$.
- Fig. 7.** BU. 366. *Leptella (Merciella) vesper*, subgen. et sp. nov. Internal cast of young ventral valve. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, Old Storridge Common, near Alfrick, Worcestershire. $\times 2$.
- Fig. 8.** BU. 367. Ditto. Internal cast of mature ventral valve. Same horizon and locality. $\times 2$.
- Fig. 9.** BU. 368. Ditto. Same horizon and locality. $\times 2$.
- Fig. 10.** BU. 369. Ditto. Internal cast of dorsal valve. Same horizon and locality. $\times 2$.
- Fig. 11.** BU. 370. Ditto. Same horizon and locality. $\times 2$.
- Fig. 12.** BU. 369. Ditto. Plasticine cast of syntype. Interior of dorsal valve. $\times 2$.
- Fig. 13.** BU. 374. *Plectodonta millinensis* cf. var. *canastonensis* O. T. Jones. Exterior of ventral valve. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, Old Storridge Common, near Alfrick, Worcestershire. $\times 2$.
- Fig. 14.** BU. 375. Ditto. Internal cast of ventral valve. Same horizon and locality. $\times 2$.
- Fig. 15.** BU. 376. Ditto. Plasticine cast. Interior of dorsal valve. Same horizon and locality. $\times 2$.
- Fig. 16.** BU. 376. Ditto. Cast of dorsal interior. Same horizon and locality. $\times 2$.
- Fig. 17.** BU. 377. Ditto. External cast of dorsal valve, with rugæ slightly developed. Same horizon and locality. $\times 2$.
- Fig. 18.** BU. 378. Ditto. External cast of dorsal valve. Same horizon and locality. $\times 2$.
- Fig. 19.** BU. 379. Ditto. Internal cast of ventral valve. Same horizon and locality. $\times 2$.

PLATE V.

- Fig. 1.** BU. 385. *Brachyprion arenaceus* (Salter MS.) forma typica. Internal cast of ventral valve. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, Old Storridge Common, near Alfrick, Worcestershire. $\times 2$.
- Fig. 2.** BU. 386. Ditto. Same horizon and locality. $\times 2$.
- Fig. 3.** BU. 387. Ditto. much more convex example. Same horizon and locality. $\times 2$.

- Fig. 4.** BU. 388. Ditto. Very convex individual, with anterior part of shell turned through more than a right angle away from the plane of the posterior part. Same horizon and locality. $\times 2$.
- Fig. 5.** SMC. A 16213. Ditto. Var? Triangular example with lengthened diductor scars and marked delthyrial callus. Probably gerontic. Upper Llandovery sandstone (Pentamerus Beds), May Hill, Gloucestershire. $\times 2$. (SMC. A 16208 21 were mentioned in Salter, 1873, *Cat. Camb. Sil. Foss. Geol. Mus. Camb.*, p. 88, as *Strophomena arenaceu* Salter MS.)
- Fig. 6.** SMC. A 16220 a. *Brachyprion arenaceus* (Salter MS.). Plasticine cast of lectosyntype. Interior of ventral valve. Short median septum expands into callus in delthyrial cavity. Muscle-scars not deeply impressed. Normal adult. Upper Llandovery (May Hill) sandstone, "close under limestone," Presteigne, Radnorshire. $\times 2$.
- Fig. 7.** SMC. A 16219. Ditto. Plasticine cast of lectosyntype. Interior of ventral valve. Longer median septum, and more clearly defined muscular area. Small shell is *Cælospiræ hemispherica* (J. de C. Sowerby). Same horizon and locality. $\times 2$.
- Fig. 8.** BU. 389. Ditto. Var. ? Plasticine cast. Interior of flat type of dorsal valve. Upper Llandovery (Pentamerus Beds), loose in nearly overgrown excavation at Old Quarries (locality 3), 440 yards north of the Beck Reservoir, Old Storridge Common, near Alfrick, Worcestershire. $\times 2$.
- Fig. 9.** BU. 390. *Brachyprion arenaceus* (Salter MS.). Plasticine cast. Interior of concave dorsal valve (the normal condition), with median elevation branching posteriorly. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, near Alfrick, Worcestershire.
- Fig. 10.** SMC. A 16220 b. Ditto. Plasticine cast of lectosyntype. Exterior of ventral valve (same as fig. 6). Note epizoite (? or epinecrite) tubes. Upper Llandovery (May Hill) sandstone, Presteigne, Radnorshire.

PLATE VI.

- Fig. 1.** BU. 393. *Brachyprion arenaceus* var. nov. *geniculatus*. A very convex transitional example, with short median septum separating ill-defined adductor insertions. Upper Llandovery (Pentamerus Beds), Old Quarries (locality 3), 440 yards north of Beck Reservoir, Old Storridge Common, near Alfrick, Worcestershire. $\times 2$.
- Fig. 2.** BU. 394. Ditto. Typical example showing elongate diductor scars with outer boundary ridges subparallel. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, near Alfrick, Worcestershire. $\times 2$.
- Fig. 3.** SMC. A 16218. Ditto. ? External cast of dorsal valve, with anterior notch corresponding with position of excretal current. Upper Llandovery (May Hill) sandstone, "close under limestone," Presteigne, Radnorshire. Approx. actual size.
- Fig. 4.** BU. 395. Ditto. Internal cast of ventral valve. Median septum separates narrow, elongate adductors which are nearly half the length of the prominent diductor scars. Callus in the delthyrial cavity forks in front. Upper Llandovery silicified sandstone (Division 115 of Wills, Wilkins and Hubbard, 1925, also containing Bryzoa and small *Stricklandiolaria* forms α , St. Joseph), Rubery, Worcestershire. $\times 2$.

- Fig. 5.** BU. 396. Ditto. Internal cast of large, flat ventral valve. Note concave outline of diductor scars. Upper Llandovery Purple Shales, Division O, 1070-1075 feet down, Walsall Co-operative Society Boring, Walsall, South Staffordshire. $\times 1\frac{1}{2}$.
- Fig. 6.** BU. 397. *Brachyprion arenaceus* var. nov. *lobatus*. Internal cast of large ventral valve. Note diverging lobate diductor scars, distinguished from those in a form like SMC. A 16220 *a* (Pl. iii. fig. 6) by the well-marked lateral ridges. Upper Llandovery Purple Shales, Division O, 1029-1034 feet down; same locality. $\times 1\frac{1}{2}$.
- Fig. 7.** BU. 740. *Camarotoechia transversaria*, sp. nov. Internal cast of ventral valve. Adult showing cast of delthyrial cavity, dental lamella, and lightly impressed adductors in the middle of an oblong, radially furrowed diductor area. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, near Alfrick, Worcestershire. $\times 2$.
- Fig. 8.** BU. 402. Ditto. ? Gerontic individual. Dental lamellæ less sharply defined and small, deeply impressed, compact adductors, separated by a short, local median septum. Same horizon and locality. $\times 2$.

PLATE VII.

- Fig. 1.** GSM. 11692. *Brachyprion arenaceus* (Salter MS.). Exterior of ventral valve, with shell partly removed. Probably forma typica, but somewhat transverse. C. J. Stubblefield regards this as the specimen figured by Davidson from Norbury (1871, Pl. xlii. figs. 6, 6 *a-b*). Upper Llandovery calcareous silt. $\times 2$.
- Fig. 2.** GSM. 11461. *B. arenaceus* var. nov. *lobatus*. Internal cast of ventral valve. Upper Llandovery (Pentamerus Beds), Gunwick Mill, near Alfrick. $\times 2$. (Figured by Davidson, 1871, Pl. xlii. fig. 7.)
- Fig. 3.** GSM. 11460. *B. arenaceus* var. nov. *geniculatus*. Internal cast of ventral valve. Upper Llandovery decalcified sandstone with *Stricklandia lirata* (J. de C. Sowerby), Huntley Hill. $\times 2$. (Figured by Davidson, 1871, Pl. xlii. fig. 8.)
- Fig. 4.** BU. 391. *B. arenaceus*. Cast of interior of ventral valve, with linear adductors on a median ridge, and triangular adductor scars poorly defined anteriorly. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, near Alfrick, Worcestershire. $\times 2$.
- Fig. 5.** BU. 398 *a*. *Brachyprion* sp. Internal cast of dorsal valve. Note two strong rugæ on each side, making an acute angle with the hinge-line. Upper Llandovery calcareous sandstone, sunk track through Coneygore Coppice (locality 1), 1200 yards east of Lower Tundridge Farm, near Alfrick, Worcestershire. $\times 2$.
- Fig. 6.** BU. 398 *a*. Ditto. Plasticine cast. Interior of dorsal valve. Same horizon and locality. $\times 2$.
- Fig. 7.** BU. 403 *a*. *Stegerhynchus* (?) cf. *weaveri* (Salter MS.). Plasticine cast. Exterior of ventral valve. Upper Llandovery (Pentamerus Beds). Loose material at Old Quarries (locality 3), 440 yards north of Beck Reservoir, Old Storrige Common, Worcestershire. $\times 2$.
- Fig. 8.** BU. 403 *b*. Ditto. Internal cast of ventral valve, showing transverse ridge separating off delthyrial cavity, casts of diverging dental lamellæ, and diductor insertions. Same horizon and locality. $\times 2$.

- Fig. 9.* BU. 404. ? Ditto. Internal cast of dorsal valve, with strong median septum and divided hinge-plate. Also note presence of apparent, narrow, linear cardinal process. Same horizon and locality. $\times 2$ (approx.).
- Fig. 10.* BU. 405. Ditto. Internal cast of ventral valve of young individual, in which transverse ridge bounding the delthyrial cavity in front has only begun to develop. Same horizon and locality. $\times 2$.
- Fig. 11.* BU. 399 a. *Canarotachia numerosa*, sp. nov. Internal cast of ventral valve. It has many ribs but is not a common fossil. Loose blocks at Old Quarries (locality 3), 440 yards north of Beck Reservoir, Old Storridge Common, near Alfrick, Worcestershire. $\times 2$.
- Fig. 12.* BU. 408 a *Spirifer (Crispella) anglica*, sp. nov. Internal cast of dorsal valve. Loose material at Old Quarries (locality 3), 440 yards north of Beck Reservoir, Old Storridge Common, near Alfrick, Worcestershire. $\times 2$.

LXIX.--*New Species of Oriental Staphylinidæ (Col.)*.

By MALCOLM CAMERON, M.B., R.N., F.R.E.S.

OXYTELINÆ.

Priochirus (Cephalomerus) Annamensis, sp. n.

Black, shining. Length 15-16 mm.

Size of *bifoveatus* Epp., but with shorter antennæ, the inner frontal horn much more developed, the head behind without foveæ, the thorax narrower, transversely convex with distinct fovea on each side of the median sulcus, the sides evenly rounded, the bases of the tergites more coarsely punctured. Head narrowly and deeply sulcate along the middle, the inner frontal horn stout and largely free, pyramidal, pointed, erect, the antero-external angle of the head prominent and rounded, separated from the base of the inner horn by a large concave impression, the postero-external angles prominent and everted. Antennæ with the intermediate segments moniliform, the penultimate slightly transverse. Thorax transverse, convex, deeply sulcate along the middle, on each side of the sulcus with a large fovea, the sides gently rounded and coarsely and rather closely punctured, the base bordered and with some rather large punctures. Elytra longer than the thorax, along the sides longitudinally impressed so that the lateral margin appears elevated, very finely

and sparingly punctured. Abdomen closely and rather coarsely punctured at the bases of the tergites.

In general facies like *Stigmatoporus abori* Bernh.

Tonkin : Chapa. Type in J. Clermont's Collection, co-type in mine.

STENINÆ.

Stenus (Hypostenus) yunnanensis, sp. n.

Moderately shining, black. Antennæ and legs roddish yellow. Length 4.75 mm.

Very near *bispinus* Motsch., but differing in the following respects : less shining, the smooth space on the vertex of head less developed, the thorax and elytra with the puncturation distinctly coarser and more rugose ; the abdomen scarcely differs from *bispinus* in build and in the puncturation of the first three visible tergites, but that of the 4th and 5th is much less fine and closer and the apex is without the two spines present in *bispinus*. Head narrower than the base of the elytra superficially bisulcate, with narrow, smooth rather indistinct shining space before the middle of the base, elsewhere coarsely and closely punctured. Antennæ moderate, slender, the 3rd to 10th segments all much longer than broad, decreasing in length, the 11th about half as long as the 10th. Thorax nearly cylindrical, longer than broad (3.3 : 2.5), narrowed before the base, closely, coarsely, rugosely punctured. Elytra nearly twice as broad as the thorax and longer (4 : 3.3), as long as broad, as closely but rather more coarsely punctured. Abdomen with the first three visible tergites strongly constructed at their bases, the first four closely and moderately coarsely, the 5th closely but less coarsely punctured, its posterior margin smooth. Pubescence white and scanty except at the base of the first three visible tergites where it is rather close.

♂ : unknown.

Yunnanfou. Type in coll. Clermont. Co-type in my collection.

PÆDERINÆ.

Scopæus tonkinensis, sp. n.

Moderately shining, black, the under surface reddish brown. Antennæ reddish yellow. Legs brownish yellow, the femora somewhat infusate above. Length 3 mm.

In the less oval, more trapezoidal thorax approaches *laticollis* cam. Head subquadrate, broader than the thorax, slightly broader than long, the posterior angles rounded. Very finely and densely punctured. Antennæ with the 3rd segment slightly longer than the 2nd, 4th to 7th a little longer than broad, decreasing in length, 8th to 10th about as long as broad. Thorax slightly longer than broad (2 : 1.5) trapezoidal, the anterior angles obtusely rounded, before the scutellum with a pair of small obsolete foveæ and a very fine impressed median line extending to about the middle, less densely punctured than the head, the punctures larger but superficial and obsolete. Elytra as long as the thorax, as long as broad, closely, finely and roughly punctured. Abdomen very finely and closely punctured and pubescent.

♂ : 8th sternite with a deep triangular excision, its apex rounded.

Tonkin : Hoa Binh. Type in coll. Clermont. Co-type in my collection.

Dolicaon tonkinensis, sp. n.

Only differs from *robustus* Kr. in the following respects : the head is shorter, more transverse, the temples shorter, not straight and parallel but feebly rounded and retracted, the punctures rather more numerous ; puncturation of thorax as close but evidently finer than in *robustus* ; the elytra longer than broad (7 : 6), longer than the thorax, the puncturation much closer and finer.

Tonkin : Hoa-Binh. (*A. de Cooman*). Type in Clermont Coll. Co-type in my collection.

Philonthus thailandicus, sp. n.

Shining, head black, thorax and scutellum red, the former with dorsal row of four punctures, elytra an abdomen dark reddish brown, the latter iridescent with the posterior margins of the first three visible tergites rufescent. Antennæ blackish, the first two segments and legs reddish yellow. Length 4 mm.

Build of *Minutus* Boh., and with similarly constructed antennæ, differs in the colour, the thorax with only four punctures in the dorsal row and in certain lights iridescent ; elytra not quite so closely punctured, the abdomen much

less closely punctured, the pubescence much less close, long, coarse and setiform.

Siam : Renong (*Doherty*). Unique. British Museum.

Philonthus orientis, sp. n.

Head black, iridescent; thorax red, iridescent with dorsal row of six rather large punctures; elytra blackish brown; abdomen red. Antennæ black, the first two segments and base of the 3rd yellowish red. Legs reddish yellow. Length 5 mm.

Head very slightly broader than long, subquadrate, the posterior angles rounded, as broad as the thorax, the eye distinctly shorter than the post-ocular region; median interocular punctures widely separated, disc on each side with a row of three punctures converging towards the neck, behind the eyes with a few small punctures; ground-sculpture fine, wavy. Antennæ rather short, the 3rd segment longer than the 2nd, 4th and 5th slightly longer than broad, 8th to 10th as long as broad, scarcely differing. Thorax as long as broad, the sides straight, slightly retracted towards the front, with dorsal row of six rather large punctures and externally with two others; ground-sculpture as on the head. Scutellum with fine close rough sculpture. Elytra as long as but broader than the thorax. Slightly transverse (4 : 3.5), finely and closely punctured and without ground-sculpture, the humeral angles each with a long seta, the pubescence rather long, yellow. Abdomen rather closely and more finely punctured than the elytra, the pubescence rather long, yellow, and with a few longer setæ; ground-sculpture very fine, transverse. First segment of the posterior tarsi as long as the last.

♂: 6th sternite with small rectangular emargination in the middle of the posterior border.

Siam : Renong (*Doherty*). Unique. British Museum.

Ontholestes siamensis, sp. n.

Fore-parts orange-red variegated with patches of golden, silvery and brown pubescence: Abdomen with the first two and last visible tergites reddish yellow, the intermediate black, the first densely covered with golden pubescence, at the middle with a pair of dumb-bell shaped patches of brown hairs; 2nd with similar

pubescence, but with the brown patches less defined, broader and nearer the sides; 3rd black with golden and silvery pubescence along the middle and at the sides, at the base near middle with a pair of round patches of black pubescence, 4th and 5th with black pubescent bases, elsewhere with the golden and silvery hairs; 6th shining, yellow with scattered yellow hairs. Antennæ with the first five segments reddish brown, the following black. Legs reddish yellow, the middle and posterior femora infusate in the middle below, the posterior tibiæ infusate before the apex. Length 14 mm.

In build much like *elegans* Cam., but with larger head, smaller eyes, much shorter and stouter antennæ and differently and much more brightly coloured. ♂: head transverse, subquadrate, a little broader than the thorax, the temples a little shorter than the eyes, gently rounded, not dilated, the posterior angles rounded. Labrum yellow, short, distinctly broader than long with numerous long yellow setæ: front bi-impressed, yellow, truncate in front, impunctate; sculpture of the head elsewhere finer than in *elegans*, close, umbilicate and rugulose, the pubescence short and golden on the disc with four patches of scanty blackish hairs. Antennæ short, the 3rd segment about a third longer than the 2nd, 4th and 5th subequal, scarcely longer than broad, 6th to 10th transverse, subequal, serrate. Thorax slightly transverse, trapezoidal, the sculpture finer than that of *elegans*, close and umbilicate, at the anterior border near the anterior angle on each side with small patch of golden pubescence, on each side near the middle with a larger patch of similar pubescence mixed with a few silvery hairs, behind the neck on each side with a small patch of black hairs and here and there with long semi-erect black hairs. Scutellum closely covered with golden pubescence, on each side with a patch of dark brown hairs. Elytra a little longer (13:10) and broader than the thorax, on each with three small patches of silvery hairs, two near the side, the other between them near the suture, elsewhere closely covered with golden pubescence. Underside of head orange-red, meso- and meta- sterna black with bluish green reflex. 6th sternite with small arcuate emargination at the middle of the posterior border.

Siam; Renong. (*Doherty*). Unique. British Museum.

Ontholestes olivaceus, sp. n.

Black, the fore-parts densely covered with greenish-yellow pubescence mottled with black; front of head (including the antennal tubercles) and labrum yellow; anterior angles, sides and base of the thorax narrowly reddish; scutellum black, tomentose, the base narrowly bordered with yellowish pubescence; elytra black with the sides, posterior margin and suture (narrowly) reddish; abdomen with the posterior margins of the first three visible tergites narrowly reddish, the 8th yellow. Antennæ reddish yellow, the 6th to 9th segments black. Legs reddish yellow, the middle and posterior femora each with a small brown spot at the middle of the anterior border. Length 20 mm.

Longer and narrower than *siamensis* Cam. and of black ground-colour with dense greenish-yellow pubescence except on the last three tergites, so that it presents an olivaceous colour, the antennæ also are much longer and of different colour. ♂: head a little broader than the thorax, transversely suborbicular, the eyes large, longer than the post-ocular region; labrum broader than long with numerous yellow setæ; sculpture close and consisting of small umbilicate punctures, closely covered with greenish-yellow pubescence but with four patches of black, viz. a small round pair a little behind the front and a larger more oval pair before the base. Antennæ long and slender, the 3rd segment three times longer than the 2nd, 4th and 5th of equal length, together about as long as the 3rd, 6th to 8th much shorter decreasing in length, 9th and 10th about as long as broad. Thorax as long as broad, the sides distinctly arcuately retracted behind, the sculpture as on the head, the greenish-yellow pubescence forming a cruciform figure which is interrupted in the middle by a narrow elongate streak of black pubescence, the posterior part of the cross is joined on each side by an oblique fascia of greenish-yellow pubescence, so that there are eight areas of black pubescence. Elytra a little longer than the thorax, distinctly marmorate. Abdomen with the 1st visible tergite with large square black tomentose patch in the middle, at the centre of its anterior border with a small patch of yellow hairs, the sides of the segment closely covered with greenish-yellow hairs; 2nd closely covered

with similar pubescence except along the posterior margin and at the middle of the base with a pair of small spots of brownish hairs; 3rd with a pair of black fasciæ along the middle, elsewhere closely covered with greenish-yellow pubescence; 4th and 5th closely covered with black and brown hairs; 6th yellow with numerous yellow hairs and a few black setæ. Head black below; metasternum red; 6th sternite with a small triangular impression at the middle of the posterior margin, its base arcuately emarginate.

Siam: Renong (*Doherty*). A single specimen in the British Museum.

Ontholestes marginatus, sp. n.

Head black, the pubescence black, the front (including the antennal tubercles and labrum) yellow, thorax black, the pubescence black, the anterior border narrowly and obscurely red, the anterior angles, sides, and posterior border more broadly and distinctly red; scutellum black, tomentose with a few yellow hairs at the base; elytra black, the humeral angles and reflexed sides reddish, the posterior margin narrowly yellow, across the middle of each with a golden-yellow fascia dilated externally and with two small patches of silvery pubescence in it, behind it with a crescentic fascia of golden hairs, along the suture with similar pubescence, the pubescence elsewhere black; abdomen black, the posterior margin of the first three visible tergites red, the 6th yellow, the first of them with golden-yellow pubescence at the sides, the second at the base with a pair of small patches of reddish-brown hairs, elsewhere with close golden-yellow pubescence, the third with a pair of parallel black tomentose fasciæ along the middle, between them at the base with a few golden hairs, the sides with similar pubescence, the fourth closely covered with black and brown hairs, at the middle of the base with a small patch of yellow hairs, the fifth like the preceding but without the basal spot, sixth yellow, with numerous long yellow setæ. Antennæ long and slender, reddish yellow, the 6th to 9th segments black. Legs reddish yellow, the anterior and middle femora with small brown spot at the middle of the anterior border, the posterior more extensively infuscate along the front. Length 20 mm.

♂: head a little broader than the thorax, transversely suborbicular, the eyes large, as long as the rounded post-ocular region; labrum transverse; front bi-impressed, truncate, impunctate, the surface elsewhere with close rugulose sculpture, in the middle between the eyes with a small shining tubercle. Antennæ with the 3rd segment nearly three times longer than the 2nd, 4th and 5th much longer than broad, equal, 6th a good deal shorter, 7th to 10th gradually decreasing in length, the 10th very slightly longer than broad. Thorax scarcely broader than long, the sides arcuately retracted behind, rugulose. Elytra a little longer and broader than the thorax, transverse, the sculpture fine and rugose. Head below black, metasternum reddish brown, the first three sternites red, the 4th and 5th black, the 6th yellow with a narrow triangular impression at the middle of the posterior margin, its base with a small arcuate emargination.

Siam: Renong (*Doherty*). Unique. British Museum.

ALBOCHARINÆ.

Gyrophæna (s. str.) *siamensis*, sp. n.

Shining, light ferruginous red; the elytra brownish yellow extensively infuscate at the sides and behind, thorax with irregular dorsal row of seven small superficial punctures. Antennæ reddish yellow, the first three segments and legs yellow. Length 1.75 mm. Build of *nana* Payk. but less robust, differently coloured and with differently constructed antennæ. Head with a few small scattered punctures. Antennæ long and slender, the 3rd segment a little shorter than the 2nd, 4th to 8th all slightly longer than broad, 9th and 10th as long as broad, 11th a little longer than the 9th and 10th together. Thorax strongly transverse (4 : 2.5), the sides evenly rounded and coarctate with the base; with irregular dorsal row of seven small superficial punctures, externally with two others. Elytra longer (3 : 2.5), and broader than the thorax, transverse (5 : 3) with a few fine scattered punctures. Abdomen extremely finely, rather sparingly punctured, the ground-sculpture extremely fine, transverse. The fore-parts without ground-sculpture.

♂: unknown.

Siam: Renong (*Doherty*). Unique. British Museum.

Stenomastax chapmani, sp. n.

In colour and lustre scarcely differing from *platygaster* Kr. but of distinctly narrower build, the antennæ black with the first three segments brownish yellow, scarcely differing in structure; punctures of head finer and fewer, the ground-sculpture scarcely different; thorax transverse (3:2.4), broadly superficially impressed on the posterior half, the fine sparing punctures more distinct than in *platygaster*; elytra as long as the thorax, scarcely transverse, the ground-sculpture stronger than in that species, the punctures not so fine and not so close; abdomen scarcely differing from *platygaster*.

♂: 8th tergite truncate in the middle, much broader than in *platygaster*, on each side with a very small arcuate emargination and with a very small tooth externally, both much smaller than in that species.

Tonkin: Hoa-Binh. Type in my collection. I am indebted to Mr. W. Chapman for this and several other species from the same region.

Falagria (Stenagria) impressicollis, sp. n.

Shining; head and thorax dark reddish brown; elytra yellow, the reflexed sides infusate; abdomen black, the first visible tergite yellow. Antennæ black, the first two segments, base of the 3rd and apex of the 11th reddish yellow. Legs reddish yellow, the apical half of the middle and posterior femora infusate. Length 3 mm.

Near *latemarginata* Bernh. Very similar in colour but with larger flatter head, longer antennæ and different sculpture. Head slightly transverse, as broad as the thorax, the eyes smaller than in *latemarginata*, the post-ocular region gently rounded and retracted, the disc broadly impressed, finely, moderately closely punctured. Antennæ long, the penultimate segments distinctly longer than broad. Thorax a little longer than broad (4:3.5), formed as in *latemarginata*, the median impression deep and broad in front, narrow behind, deeper and broader than in that species, the puncturation distinct, fine, rather close and feebly asperate. Elytra as long as the thorax, broader than long, extremely finely, moderately closely punctured, feebly asperate and finer than that of the thorax. Abdomen very finely, moderately closely punctured, the ground-

sculpture scarcely visible, the fore-parts without ground-sculpture.

Tonkin : Hoa Binh. Type in my collection.

Falagria (Stenagria) tonkinensis, sp. n.

Shining, head and thorax dark red ; elytra blackish, the base rather broadly, the apical margin narrowly reddish yellow ; abdomen black, the first two visible tergites yellow. Antennæ red, the first three segments reddish yellow. Legs reddish yellow, the apical half of the posterior femora infusate. Length 3 mm.

A rather robust species with stout antennæ. Head transverse, suborbicular, nearly as broad as the thorax, finely, rather closely punctured. Antennæ stout, the penultimate segments as long as broad. Thorax slightly longer than broad (4 : 3.75), convex, the sides almost straightly retracted behind, the posterior angles obtuse and prominent, along the middle narrowly and deeply sulcate, the puncturation as on the head. Elytra as long as the thorax, finely rather closely uniformly and asperately punctured. Abdomen finely and rather closely punctured. The insect without ground-sculpture on the fore-parts and extremely fine on the abdomen.

Tonkin : Hoa-Binh. Type in my collection.

Orphnebius (Megabocephalobius) breviceps, sp. n.

Shining ; head and thorax reddish brown, elytra and abdomen yellowish red, the former extensively infusate at the sides and posteriorly. Antennæ black, the first five segments and legs reddish yellow. Length 2.5 mm.

Head short, strongly transverse (4.5 : 2.5), slightly broader than the thorax, the eyes occupying the whole side, punctures extremely fine and few ; labrum with broad emargination in the posterior corneous part, the anterior membranous portion truncate in front. Antennæ short and stout, the 3rd segment slightly longer than the 2nd, 4th small, moniliform, 5th small, transverse, 6th to 10th (seen on the flat) more strongly transverse, increasing in width, serrate internally, the penultimate about three times broader than long, the 11th as long as the 9th and 10th together. Thorax transverse (4.3 : 2.5), the sides gently rounded, more retracted behind and coarctate with the base, except for three or four marginal soliferous

punctures without sculpture. Elytra longer (3.5 : 2.5) than the thorax, slightly widened behind, transverse (6.5 : 3.5) with a few extremely fine punctures each with a long fine hair. Abdomen scaphoidal, the 7th tergite finely and closely striate, 8th tergite rounded posteriorly, the sculpture not visible owing to retraction, the rest of the tergites without sculpture.

Siam : Renong (*Doherty*). Unique. British Museum.

Orphnebius (Mesocephalobius) opticus, sp. n.

Shining ; head and thorax light reddish brown ; elytra reddish yellow, more or less infuscate at the sides and behind ; abdomen reddish yellow. Antennæ black, the first four segments and legs reddish yellow. Length 3.75-4.5 mm.

Near *birmanus* Cam. but with much shorter 11th antennal segment, the thorax a little more transverse with the sides more retracted behind ; punctures of 7th tergite less superficial and with six distinct elongate tubercles along the posterior margin, 8th with four distinct tubercles. Head transverse, suborbicular, a little narrower than the thorax (6 : 6.5), eyes very large occupying practically the whole side, the post-ocular region much shorter than their length ; sculpture absent. Antennæ short and stout, the 3rd segment about twice as long as 2nd, 4th about as long as broad, 5th to 10th transverse, increasing in width, serrate, the penultimate segments three times broader than long, the 11th as long as the 9th and 10th together. Thorax transverse (6.5 : 5), the sides very gently rounded, more retracted behind than in front, except for four marginal punctures without sculpture. Elytra slightly longer (6 : 5) and broader than the thorax, widened behind, transverse (10 : 6) with a few very fine punctures and stiff hairs. Abdomen scaphoidal, the 7th tergite with small, rather superficial and close punctures at the base, towards the posterior margin deeper and more or less elongate ; before the posterior border with six elongate tubercles ; 8th very slightly rounded posteriorly and with four tubercles on the posterior margin, the rest of the abdomen without sculpture.

Siam : Renong (*Doherty*). British Museum.

Orphnebius (Mesocephalobius) siamensis, sp. n.

Shining; head and thorax black, elytra reddish brown, darker at the sides and posteriorly; abdomen yellowish red. Antennæ black, the first two segments and base of 3rd yellowish red. Legs yellowish red. Length 4 mm.

In colour very like *bakerianus* Bernh., but with the elytra more obscurely coloured and at once distinguished from it by the much longer antennæ, the penultimate segments fully as long as broad. Head transversely suborbicular as broad as the thorax, the eyes large but shorter than the post-ocular region; sculpture absent. Antennæ with the 3rd segment twice as long as the 2nd, 4th to 10th all longer than broad decreasing in length, the penultimate only slightly longer than broad, the 11th as long as the 9th and 10th together. Thorax as long as broad, the sides straight and practically parallel, sculpture absent. Elytra slightly longer (3:2.5) and distinctly broader than the thorax, transverse (4.5:3), practically impunctate but with a few fine hairs. Abdomen scaphoidal, with the 5th visible tergite closely and coarsely punctate-striate, elsewhere without sculpture.

♂: 6th tergite with two small widely separated elongate tubercles at the posterior margin; 7th with numerous granules posteriorly; 8th with three equal blunt teeth on the posterior margin, the upper surface closely granular. The upper margins of the first three sternites are visible from above adjacent to the first three visible tergites.

Siam: Renong (*Doherty*). Unique. British Museum.

Zyras (Dianlaconia) siamensis, sp. n.

Shining light chestnut red, the abdomen darker. Antennæ red, the 1st segment and legs reddish yellow. Length 7.3 mm.

♂: build of *compressicornis* Fauv., and except for the head and elytra of very similar colour, but smaller and narrower, the head with the punctures smaller but equally close, the ground-sculpture much weaker; antennæ similarly constructed; thorax with the dorsal row of punctures much finer, those at the sides a little finer; elytra more finely punctured, the ground-sculpture similar; abdomen with similar scanty puncturation but the

punctures smaller, the ground-sculpture the same; 5th tergite with the posterior border lightly arcuately triemarginate; 7th with a strong pointed median tubercle behind, the surface of the segment with a few scattered granules; 8th broadly truncate with several scattered granules on the upper surface.

Siam: Nan (*T. D. A. Cockerell*), 29. xii. 27. A single specimen in my collection.

LXX.—*Cretaceous Crustacea from Mount Lebanon, Syria.*

By M. F. GLAESSNER.

[Plate VIII.]

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THE following descriptions of Cretaceous crustacean constitute the second report on the results of an examination of foreign decapod Crustacea in the collection of the Geological Department of the British Museum (Natural History), carried out in 1930 and 1931. The first report, dealing with Tertiary crabs, was published in 1933 (*Ann. & Mag. Nat. Hist.* (10), xii. pp. 1–28, pls. i.–vi.). I have much pleasure in expressing my sincere gratitude to Dr. W. D. Lang, then Keeper of the Department of Geology, and to Mr. T. H. Withers, of the same Department, for allowing me facilities for my work in the British Museum and for furthering my investigations in many ways. To Mr. Withers I am particularly indebted for his active interest in the progress of my research.

The fossil Crustacean fauna of Mt. Lebanon was studied by O. Fraas (1878), and by Dames (1886). Brocchi (1875) described a single specimen of a new species, and more recently Van Straelen (1930) discussed Cretaceous Natantia from this and other localities. The Crustacean fauna is not nearly so well known as the fauna of fossil fishes from the same beds and so thoroughly investigated by Smith Woodward, Hay and others. The opportunity to examine 120 specimens of Cretaceous decapods from Hakel, Hajula and Sahel Alma, in Syria, made available to me for examination in 1931, was therefore most welcome.

DESCRIPTION OF SPECIES.

I. *Penaeidae*.

Acanthochirus cenomanicus, sp. n. (Pl. VIII. fig. 1.)

Material.—Three almost complete specimens. Holotype: B.M.N.H., In. 28645.

Type-locality.—Hakel, Mt. Lebanon (Cenomanian shale).

Description.—Carapace smooth, hepatic spine distinct. Rostrum preserved in two specimens. In the holotype it is short and shows about eight teeth, while in the other specimen it is long and pointed, but equally ornamented with teeth on the forward slope of the upper edge. This difference may be due to distortion during fossilisation or to sexual differentiation. As the two specimens agree in all other features the difference in the rostrum is not considered as specific. The abdomen is long and thick. The length of the sixth somite exceeds that of the fifth by about one-third and equals that of the telson. In one specimen the margin of the pleura of the third somite is granulate. The length of the third maxillipeds is equal to that of the carapace; all segments bear long, slightly curved spines. All legs are shorter than the carapace, but they are not sufficiently well preserved for detailed description. The antennæ are missing. The bases of the pleopods are strong.

Measurements.—Length of carapace 17 mm., length of abdomen to the end of the fifth somite 22 mm., length of the upper margin of the sixth somite 9 mm., telson 8 mm.

Comparison.—The new species differs from the type of the genus, *A. cordatus* (Münster), from the Upper Jurassic of Solenhofen, in its shorter legs and maxillipeds, and from *A. angulatus* (Münster) in the robust shape of the body. There appear to be differences in the rostrum, but these cannot be definitely stated.

Benthesicymus libanensis (Brocchi). (Text-fig. 1.)

Penæus libanensis Brocchi, 1875, Bull. Soc. Géol. France (3), iii. p. 609, pl. 21; Dames, 1886, Z. deutsch. Geol. Ges. xxxviii. p. 554; Balas, 1922, Palæont. Z. v. p. 131.

Penæus ? *libanensis* Glaessner, 1929, Foss. Cat. i. pt. 41, pp. 310, 420.

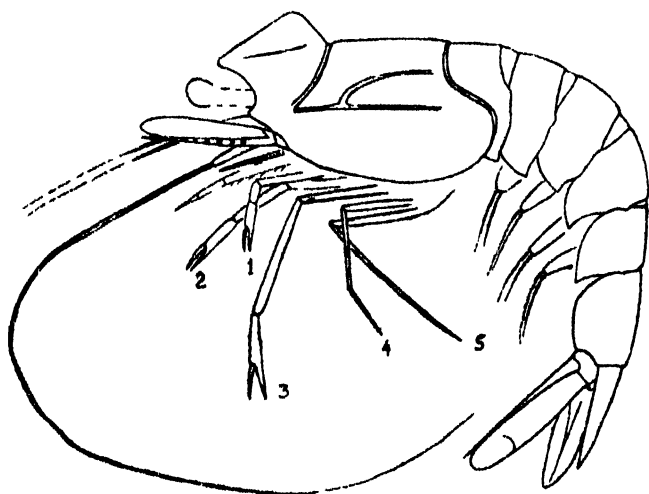
! *Penæus libanensis* Van Straelen, 1930, Bull. Mus. Roy. Hist. Nat. Belg. vi. no. 8, p. 5.

Material.—26 specimens, most of them complete with legs and antennæ.

Occurrence.—Senonian, white marly limestone : Sahel Alma, Mt. Lebanon, Syria.

Description.—Shell not strongly calcified, rather thin and soft. Rostral crest obliquely triangular, very thin, with a thickened dorsal ridge. Rostrum only slightly projecting, with blunt anterior end, without rostral teeth. Cervical furrow very narrow. A double ridge extends from the posterior margin of the carapace to the cervical furrow. Its anterior part is curved and connected with

Fig. 1.



Benthescymus libanensis (Broochi).

Senonian : Sahel Alma, Mt. Lebanon, Syria. Reconstruction
(Nat. size.)

another ridge on the upper branchial regions. The lower part of the posterior margin bends backwards in a semi-circular curve. The abdomen is strong, with short, high somites, which are approximately equal in length. The eyes are oval, large and long, but comparatively smaller than in *Penaeus natator*. The eyestalk is not preserved. The antennular stalks are not well preserved. The flagellæ are as long as the carapace, very thick at the base, but tapering rapidly. The antennal stalks are long and cylindrical, tapering near the end. The antennal flagellæ are $3\frac{1}{2}$ times the length of the carapace or about

equal to the length of the whole body. The antennal scale is large, oval and very thin, with a strong, pointed outer rib. The maxillæ are preserved in several specimens. The third maxillipeds are short, with spines on the carpus. The exopodite is articulate. The legs increase in length from first to fifth. The chelæ of the first pereopod are short, those of the second and third are long and slender. The length of the fifth leg equals that of the carapace. The pleopods are very long, equal in length to the external uropods which, in turn, exceed the length of the telson by three-quarters. The inner uropods are longer than the telson. The diæresis is semi-circular. The margins of the uropods are finely granulate.

Comparison.—The genus *Benthesicymus* was established by Spence Bate (Rep. Voy. 'Challenger,' Zool. xxiv. Macrura, 1881), to include a number of Recent abyssal benthonic species, ranging in depth from 450 to 3050 fathoms. According to Bouvier, *Benthesicymus* is the most primitive living Penæid. Close relatives of Recent deep-sea Eryonidæ, Galatheidæ, Nephropsidæ, Thalassinidæ and Brachyura are found in Mesozoic shallow-water deposits. With the recognition of *Benthesicymus* in the Cretaceous, the Penæidæ can now be added to this list in which most of the tribes of the decapod Crustacea are represented. *B. libanensis* differs from the Recent species only in the complete lack of rostral teeth. This difference does not exclude the fossil species from the Recent genus, in which up to three teeth are known to occur. The related genus *Gennadas* (*Anomalopenæus*) is characterised by the flattened meropodites of the legs.

Specimens in the collection of the University of Geneva identified by Van Straelen (1930, p. 5) as *Penæus libanensis* Brocchi, possess seven suprarostal teeth and cannot, therefore, belong to that species. Seven or eight suprarostal teeth were observed in three specimens in the British Museum from Hakel (B.M.N.H., I. 148, I. 622, I. 4551) and in two specimens from Sahel Alma (B.M.N.H., 59688 and 59689), of which the second has all three pairs of chelate legs preserved. The specimens from the Cenomanian, as well as those from the Senonian, represent the genus *Penæus*, but they are not sufficiently well preserved for specific identification.

Genus CARPOPENÆUS, gen. nov.

Diagnosis.—Penæid with the carpus of the second and third pereopods articulate, resembling the carpus of the second leg in many genera of the Caridea. Seven or eight teeth on the rostrum. Carapace with longitudinal fissure.

Genotype: *C. callirostris*, sp. n.

Carpopenæus callirostris, sp. n. (Pl. VIII. fig. 2; text-fig. 2.)

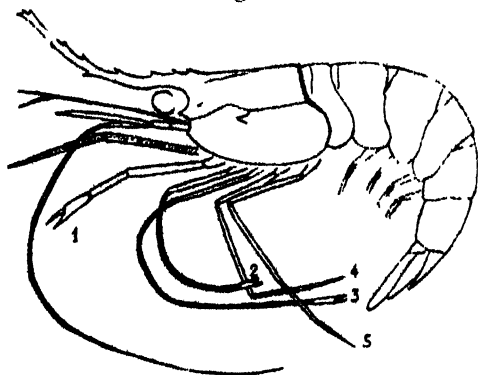
Material.—35 specimens, mostly complete. Holotype: B.M.N.H., I. 5003.

Occurrence.—Cenomanian shale: Hajula, Hakel (12 specimens), Mt. Lebanon, Syria.

Diagnosis.—Rostrum longer than the carapace, curved, ending in three teeth. Third maxilliped almost equal in length to the first pereopod. Legs increasing in length from first to fifth.

Description.—Carapace short. Rostrum very long, nearly straight in its proximal half, curved upward beyond the infra-rostral spine. Three short spines at its tip and six teeth along its upper edge. A sharp ridge extends from the base of the rostrum along the median line of the carapace. A horizontal fissure cuts across the flank

Fig. 2.



Carpopenæus callirostris, gen. nov., sp. n.

Cenomanian: Hakel and Hajula, Mt. Lebanon, Syria.
Reconstruction. ($\times 2$.)

of the carapace from the orbital to the posterior margins. Its exact position in relation to the antennal spine cannot be indicated with certainty. Distinct antennal and hepatic spines are present. No furrows are seen on the

carapace. The sixth somite of the abdomen is longer than the fifth, but only by about one-third. The telson is pointed, with a slight median depression and two pairs of spines. The eyes are not very large, and are rounded: the eyestalks are not clearly preserved. The stalks of the inner antennæ are very long, reaching beyond the infra-rostral tooth. The flagellæ are very short (only a few mm. long), and equal. The stalks of the antennæ are little more than half the length of the antennular stalks. Of the scale, which was evidently membranaceous, only the long pointed outer rib is preserved. Together with the basal segments its length equals that of the antennular stalks. The length of the third maxilliped exceeds that of the carapace by one-half. The first pair of legs is equal in length to the third maxillipeds. The chelæ are long and strong. The ischium and merus of the second and third pereopods are normal in shape and length, but the carpus is multi-articulate, as in some Recent and fossil Caridea (e.g., *Blaculla*). The chelæ of the second and third pair are very small. The articulate carpus and chela of the third leg are longer than the corresponding parts of the second pereopod. The fourth and fifth pereopods are long and slender, as in other Penæidæ. The appendages of the first abdominal somite are unknown, the remaining pleopods are rather short. The uropods are only very slightly longer than the telson. The diæresis is present.

Carpopenæus septemspinatus (Dames). (Pl. VIII. fig. 3.)

Penæus septemspinatus Dames, 1886, Z. deutsch. Geol. Ges. xxxviii. p. 554, pl. 13, fig. 1; Balss, 1922, Palæont. Z. v. p. 131; Glaesner, 1929, Foss. Cat. 1. pt. 41, pp. 310, 420; Van Straelen, 1930, Bull. Mus. Roy. Hist. Nat. Belg. vi. no. 8, p. 4.

Material.—One specimen, the holotype, seen by the author in 1931 in the collection of the Naturkunde Museum, Berlin.

Occurrence.—Cenomanian shale: Hakel, Mt. Lebanon, Syria.

Diagnosis.—Rostrum short, with a short terminal spine and seven supra-rostral teeth. Probably one infra-rostral tooth present. The third maxillipeds are much shorter than the first pereopods. The carpopodites of the second and third pereopods articulate, subequal in length.

Description.—Carapace short. Rostrum shorter than the carapace, ending in a terminal spine and with seven

teeth along its upper edge. One infra-rostral tooth is probably present. One longitudinal suture is seen on the carapace. The relative length of the abdominal somites is uncertain because of the crushed condition of the specimen. The telson is short. The antennular stalks are long and slender, and project beyond the rostrum. The length of the antennal flagella exceeds that of the carapace and rostrum by one-half. The third maxillipeds are short and slender, with short spines on the upper and lower edges. The first pair of pereopods is long, with strong chelæ. Only a fragment of the articulate carpus of the second pereopod is preserved. The third pair has a long articulate carpus, but the chelæ are missing in the specimen. The fourth and fifth pairs are also incomplete.

Comparison.—Dames, who described the present specimen, overlooked the peculiar antenna-like annulation of the carpus in the second and third pereopods. The same extraordinary feature was found in *C. callirostris*. *C. septemspinosus* differs from this species in the shape of the rostrum, in the length of the third maxillipeds and probably in the length of the second pereopods, which, if correctly interpreted from fragmentary evidence, were probably not much shorter than the third pereopods. There is little difference in the shape of the body and of its appendages, and the peculiar longitudinal suture is present in both species. The rostrum is different in shape, but the number and position of the rostral teeth is similar.

Pensæus natator, sp. n. (Text-fig. 3.)

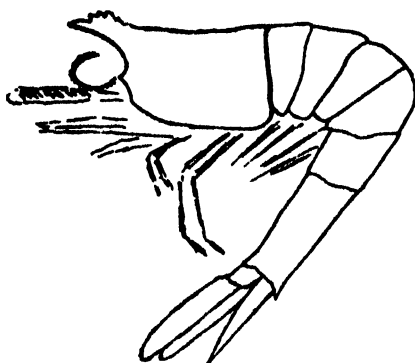
Material.—Six rather indistinctly preserved specimens, showing the cephalothorax and abdomen, most of the legs, the eyes, and parts of the antennæ. Holotype: B.M.N.H., 59690.

Occurrence.—Senonian, white marly limestone: Sahel Alma, Mt. Lebanon, Syria.

Description.—Rostrum rather long, with at least six teeth on its convex upper edge. Abdomen strong, sharply bent downward between the third and fourth somites. Sixth somite very long, about twice the length of the fifth, with a short terminal spine on its upper edge. Eyes oval, very large, with a fringe of short hairs. Antennal scale covered with fine close-set parallel grooves

extending from the inner margin outward and backward, irregularly alternating in length. The antennular and antennal flagellæ were probably rather short. The first pair of legs is short, with small rounded chelæ. The second pair is longer, with slender chelæ; the third pair is still longer, but the chelæ are not preserved. The fourth and fifth pairs of pereopods are not much longer than the carapace. The legs are comparatively short and thin in relation to the carapace. The pleopods are strong, the uropods are not much longer than the telson. A diarsis is present.

Fig. 3.

*Penæus natator*, sp. n.

Senonian; Sahel Alma, Mt. Lebanon, Syria. Holotype. (Nat. size.)

Comparison.—This species differs from the known fossil Penæidæ in its highly developed sixth abdominal somite. In this character it resembles the genus *Bombur*, incomplete specimens of which are known from the Upper Triassic and Upper Jurassic. A very striking similarity is found between the new species and the living *P. philippinensis* Spence Bate (Rept. Voy. 'Challenger,' Zool. xxiv. p. 261, pl. 35, figs. 2, 3). There are, however, differences in the shape of the carapace, the eyes, and probably also the rostrum. This Recent benthonic species was found near Celebes, the Kei and Admiralty Islands at depths from 80 to 150 fathoms. Another similar Recent species is *P. serratus* Spence Bate, which occurs at 315 fathoms near Fiji. A young specimen was obtained in Torres Straits at a depth of 1,400 fathoms. *P. natator* is a specialised member of the genus *Penæus*, the structural

evolution of which appears to have been virtually completed before the end of the Cretaceous.

Incomplete specimens indicate the presence of other species of *Pensæus* in the Cenomanian and Senonian of the Lebanon. Some of them appear to have been wrongly identified with "*P.*" *libanensis* Brocchi (see above).

II. Nephropsidae.

Homarus hakelensis (O. Fraas). (Pl. VIII. figs. 4, 5.)

Pseudastacus hakelensis O. Fraas, 1878, Jahresh. Ver. f. vaterl. Naturk. Württemberg, xxxiv. p. 346, pl. 6, fig. 1, Dames, 1886, Z. deutsch. Geol. Ges. xxxviii p. 557, pl. 13, fig. 3, pl. 14, Glaessner, 1929, Foss. Cat. i. pt. 41, pp. 351, 423.

?*Pseudastacus minor* O. Fraas, 1878, Jahresh. Ver. f. vaterl. Naturk. Württemberg, xxxiv. p. 346, pl. 6, fig. 2, Dames, 1886, Z. deutsch. Geol. Ges. xxxviii. p. 558, Glaessner, 1929, Foss. Cat. i. pt. 41, pp. 351, 424.

Material.—30 specimens, mostly complete.

Occurrence.—Cenomanian shale: Hakel, Hajula (2 specimens), Mt. Lebanon, Syria.

Remarks.—This Crustacean has none of the characteristic features of *Pseudastacus*, such as the equal, slender, straight chelæ, and the unusually deep cervical furrow. The arrangement of the furrows of the carapace is not clearly visible in the crushed specimens from the shales, but the shape of the chelæ leaves no doubt about the taxonomic position of this species. The chelæ are very similar to those of the living *Homarus vulgaris*, but differ slightly more in size. The length of the rostrum is about the same, but in the fossil species it had apparently no teeth. Woods and Van Straelen proposed to extend the use of the generic name *Homarus* to most of the Cretaceous and Tertiary lobsters which were previously known as *Hoploparia*. The results of unpublished studies indicate marked differences in the arrangement of the furrows of the carapace in these two genera. The Syrian species is provisionally placed in the genus *Homarus*, with which it agrees in all recognisable characters. *H. hakelensis* differs from the species of *Hoploparia*, occurring in the English Upper Greensand, in the shorter dactyli of the chelæ and in the smaller size.

"*Pseudastacus*" *minor* is probably a synonym of *H. hakelensis*. Young individuals of this species are less heterochelous and have much shorter chelæ. It seems likely that Fraas described as *P. minor* a poorly preserved young specimen of *H. hakelensis*.

III. Scyllaridæ.

Parribaccus ? *præcursor* (Dames).

Ibacus præcursor Dames, 1886, Z. deutsch. Geol. Ges. xxxviii. p. 555* pl. 13, fig. 2.

Ibacus ? *præcursor*, Glaessner, Foss. Cat. i. pt. 41, pp. 225, 425.

Material.—A specimen showing the ventral surface of the cephalothorax, the abdomen, and the inner and outer antennæ. B.M.N.H., I. 5018. The holotype was examined by the author in 1931 in the Naturkunde Museum, Berlin.

Occurrence.—Cenomanian shale : Hakel (holotype) and Hajula, Mt. Lebanon, Syria.

Description.—The available material is not sufficiently well-preserved for a full description of the species. The carapace is nearly rectangular in outline, with the margins only slightly diverging towards the front. The length of the carapace equals that of the abdomen and also the width of the frontal margin. A granulation appears to be present on the lateral margins. Antennal plates large, oval and longer than wide, outer margins denticulate. The teeth, numbering about twenty, are close-set, equal in size, and triangular. The basal plate of the antenna is not clearly visible, since in ventral view it is obscured by the terminal plate. The antennular stalks and probably one flagella are preserved. The abdomen was described by Dames ; its median ridge is recognisable in the new specimen.

Remarks.—The discovery of the carapace and antennæ of this species provides support for Dames' view that it is related to "*Ibacus*" *antarcticus* Dana, a species which has since been placed in the genus *Parribaccus*. The diagnostic characters of this genus, however, cannot be seen in the present specimens.

Measurements of the new specimen are :—Length about 21 mm., length of the carapace 7 mm., width of the carapace 7 mm., length of the antennæ 4 mm.

IV. Raninidæ.

LOPHORANINELLA, gen. nov.

Diagnosis.—A Raninid with the anterior portion of the carapace ornamented with granulated ridges marking the regions (as in *Notopocorystes carteri*), but with the posterior part covered with simple transverse granulated ridges

as in *Lophoranina*. Three spines on each antero-lateral margin.

Genotype: *Ranina cretacea* Dames.

Lophoranimella cretacea (Dames).

(Pl. VIII. figs. 6, 7; text-fig. 4.)

Ranina cretacea Dames, 1886, Z. deutsch. Geol. Ges. xxxviii. p. 553.

Ranina ? (*Lophoranina* ?) *cretacea* Glaessner, 1929, Foss. Cat. i. pt. 41, pp. 366, 430.

Ranina (*Lophoranina*) *cretacea* Lörentz and Beurlen, 1929, Geol. Hungar. Ser. Pal. fasc. 3, p. 292.

Material.—One large specimen, B.M.N.H., I. 4553, collected and presented by Sir Arthur Smith Woodward, 1900, and developed from the shale by Mr. T. H. Withers. Nine much smaller specimens. The holotype (No. k123a) was examined by the author in 1931 in the Naturkunde Museum, Berlin.

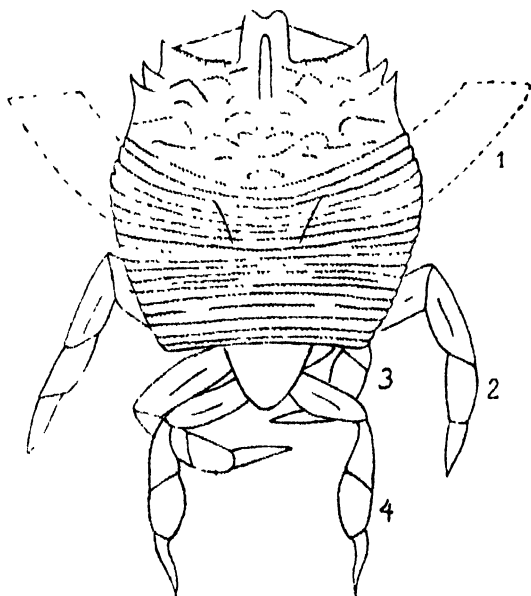
Occurrence.—Cenomanian shale: Hakel, Hajula (2 specimens), Mt. Lebanon, Syria.

Description.—The large specimen (B.M.N.H., I. 4553) shows many important characters which make it possible to decide the question of the generic position of this interesting species. The carapace has a broadly rounded outline. Its anterior margin is straight. The rostrum is long, rectangular in outline and horizontally projecting, with a notched anterior margin and raised sides. The orbits occupy the entire anterior margin; their outer angles reach forward beyond the level of the inner angles. There are two small fissures on the upper orbital margin, which appears to end in a short extra-orbital spine. The infra-orbital margin is granulate. The anterior part of the lateral margin is ornamented with two spines. The posterior lateral spine is long and pointed. The sculpture of the posterior portion of the carapace was described by Dames. According to this description there are 16 or 17 transverse ridges, some of which bifurcate. The occurrence of bifurcation cannot be confirmed, but some ridges are interrupted. Their anterior edges bear fine granules (not pits as stated by Dames). Shallow lateral cardiac furrows are visible on the posterior portion of the carapace. The ornamentation of the anterior part consists of curved, widely spaced, short, granulated ridges. The gastric region, with the mesogastric lobe on the basal part of the rostrum, and the cervical furrow are clearly marked. The legs are preserved in small specimens in what appears to

be their original position; they are broad and flattened. The first and fifth pairs are missing. The width of the dactylus decreases from the second to the fifth pair.

Measurements.—The length of the broken large specimen must have been about 30 mm., its width not more than 24 mm. The length of the holotype is 17 mm. The small specimens vary in size from 5 to 10 mm.

Fig. 4.



Lophoranimella cretacea (Dames).

Cenomanian: Hakel, Mt. Lebanon, Syria.

(Based on specimen figured, Pl. . . fig. 6, and the holotype.)

Reconstruction. ($\times 2$.)

SYNOPSIS OF THE CRETACEOUS CRUSTACEA OF MOUNT LEBANON.

The following species occur in the Cenomanian shales. The numbers indicate the number of individuals examined by the author in the collection of the British Museum (Natural History), and in the Naturkunde Museum in Berlin (numbers in parentheses).

	Hakel.	Hajula.
<i>Acanthochirus cenomanicus</i> , sp. n. . . .	3	—
<i>Carpopenæus callirostris</i> , gen. nov., sp. n. . .	12	23
<i>Ann. & Mag. N. Hist. Ser. 11. Vol. xii.</i>	50	

	Hakel.	Hajula.
<i>Carpopenæus septemspinatus</i> (Dames) . .	(1)	—
<i>Penæus</i> , sp.	3	—
<i>Homarus hakelensis</i> (Fraas)	28	2
<i>Parribaccus</i> ? <i>præcursor</i> (Dames)	(1)	1
<i>Lophoranimella cretacea</i> (Dames)	8 (2)	2
<i>Sculda syriaca</i> Dames	(2)	—
<i>Pseudosculda lævis</i> (Schlüter)	(2)	—
"Stomatopod larvæ" (Van Straelen) . .	350	1

All determinable species from the Senonian white marly limestone of Sahel Alma differ from those found in the Cenomanian. This observation agrees with the results of investigations on fossil fishes from the same localities. The following species have been described from Sahel Alma :—

Benthesicymus libanensis (Brocchi).

Penæus natator, sp. n.

Penæus, sp.

Palinuridæ, gen. sp. indet.

Pseuderichthys cretaceus Dames.

Protozoëa hilgendorfi Dames.

Loriculina nætlingi Dames.

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EXPLANATION OF PLATE VIII.

- Fig. 1. *Acanthochirus cenomanicus*, sp. n. Holotype (B.M.N.H., I. 28645), nat. size. Cenomanian: Hakel, Mt. Lebanon, Syria.
- Fig. 2. *Carpopenæus callirostris*, gen. nov., sp. n. Holotype (B.M.N.H., I. 5003), $1\frac{1}{2} \times$ nat. size. Cenomanian: Hakel, Mt. Lebanon, Syria.
- Fig. 3. *Carpopenæus septemspinatus* (Dames). Holotype, nat. size. Cenomanian: Hakel, Mt. Lebanon, Syria. Naturk. Mus. Berlin.

- Fig. 4. *Homarus hakelensis* (O. Fraas). Right chela (B.M.N.H., I. 29554), nat. size. Cenomanian: Hakel, Mt. Lebanon, Syria.
- Fig. 5. *Homarus hakelensis* (O. Fraas). Left chela of same specimen (B.M.N.H., I. 29554), nat. size. Cenomanian: Hakel, Mt. Lebanon, Syria.
- Fig. 6. *Lophoranninella cretacea* (Dames). Complete but crushed specimen, slightly enlarged. Cenomanian: Hakel, Mt. Lebanon, Syria. Holotype, Naturk. Mus. Berlin (k.123a).
- Fig. 7. *Lophoranninella cretacea* (Dames). Broken large carapace (B.M.N.H., I. 4553), nat. size. Cenomanian: Hakel, Mt. Lebanon, Syria.

LXXI.-On the Genera *Tetigonia* Geoff., *Tettigonia* F., *Tettigoniella* Jac., and *Iassus* Fab. (Homiptera-Homoptera). By W. E. CHINA and R. G. FENNAH.

THE purpose of the present paper is to revise the views expressed by one of us (China, Ann. & Mag. Nat. Hist. (11) iv. pp. 584-586, 1939), and to fix validly the types of the genera *Tetigonia* Geoff. 1762, *Tettigonia* F. 1755, *Tettigoniella* Jac. 1904, and *Iassus* F. 1803, in order to contribute to the stability of nomenclature in the groups to which they belong.

The name *Tettigonia* was first proposed by Linnæus (Syst. Nat. ed. 10, p. 429, 1758) as the name of a super-specific group under his genus *Gryllus* in Orthoptera. The view is taken here that under Opinion 124 of the International Commission, this name does not have generic or subgeneric value as of 1758, and does not invalidate the subsequent use of *Tettigonia* as a generic name. *Tetigonia* was next proposed in the Hist. abr. des Insectes in 1762 by an author (identified in later editions of the work as Geoffroy), who separated it from *Cicada* L. in a tabular synopsis, terming the former "La procigale," and the latter "La cigale." He then stated "Quant aux procigales, il y en a beaucoup d'étrangères qui ont des formes tout à fait singulières. Parmi celles de nos pays, nous n'avons que le grand diable, le petit, et le demi-diable, dont la figure soit extraordinaire; mais les pays étrangers fournissent la *mouche porte-lanterne*, le *lucifer* de la Chine, et nombre d'autres" (Hist. abr. des Insectes, i. p. 429). From citations given earlier in the work, and the figures on plate 9, it is established beyond doubt that "le grand diable" (p. 422, no. 17) is *Cicada aurita* L. (Syst. Nat. ed. 10, p. 435 no. 11), and "le petit diable" (p. 423, no. 18) is *Cicada cornuta* L. (Syst. Nat.

ed. 10, p. 435, no. 10), while "le demi-diable" is recognizable from the original description (p. 424, no. 19) as *Membracis genistæ* F., 1775. "La mouche porte-lanterne" and "le lucifer de la Chine" are recognizable only as generic conceptions in the family Fulgoridæ.

Geoffroy did not use latin binary names in his 'Histoire abrégée des Insectes,' but he established categories, with a single latin name, and refers to them as genera (e. g. *Cicada* and *Tetigonia* are termed "ces deux genres"). This proves that such names were intended to be applied in a generic sense. He frequently cites the Linnean binary name, but himself fails to name the species in latin, though he does give the vernacular name or descriptive phrase in French. This procedure may be held to show that he applied the *principles* of binary nomenclature, and on such a view, by Opinion 46, his genus *Tetigonia* is valid.

For the present the authors accept the interpretation that this genus is valid, though while so doing they recognize that an authoritative opinion on the status of Geoffroy's 'Histoire abrégée des Insectes' may reverse this view.

Geoffroy did not fix a type for his genus *Tetigonia*: accordingly, by the provisions of Article 30 e (α), the type must be selected from among the species included under the original description. Geoffroy names three species, two generic concepts, and adds "et nombre d'autres." This addition does not require to be considered, as the unnamed species so covered were in effect *species inquirendæ* from the standpoint of the author of the generic name at the time of its publication, and under Article 30 e (β) are not available as a basis for selection. It is perhaps worth pointing out that *Tetigonia* cannot be considered on the basis of the phrase "nombre d'autres" to cover all the species in the world which agree with the generic description, as by Opinion 46 it is only in the case of a genus for which *no species whatsoever* are named that such an assumption is permissible. The type, therefore, must be selected from one of the originally included species named above. This has so far not been done, apparently, owing to a wide belief that a pseudotype, *Cicada viridis* L. (designated by Kirkaldy, 1904, Ent. xxxvii, p. 256) was the type. We now select *Cicada aurita* L. ("le grand diable") as the type of *Tetigonia* Geoffroy, being led to this choice by the facts that it is

the first species mentioned by him, it is bibliographically cited, described and figured, and is not an exotic species (Article 30, *j, n, q, r*); moreover, this action retains the genus within the Jassidæ (*sensu* Evans, 1946), a group with which Geoffroy's *Tetigonia* has been continually associated.

The name *Tettigonia* was next proposed by Fabricius in 1775 (Syst. Ent. p. 678), for a genus which he established to receive a number of species of Cicadidæ (*sens. str.*).

According to Opinion 147 (1*d*) of the International Commission, the difference in spelling between this and *Tetigonia* Geoff. is not significant. The Fabrician genus has been generally treated as being preoccupied, and no type appears to have been fixed for it, while its species have been referred to several genera. As it is at present not impossible that both *Tettigonia* L. and *Tetigonia* Geoff. may be held invalid, it is desirable that a type be fixed for the Fabrician generic concept. As the authors recognize *Tetigonia* Geoff., they are compelled to consider *Tettigonia* F. as preoccupied. They nevertheless, herewith select *Cicada plebeja* Scop. as the type of *Tettigonia* Fabricius, with a view to fixing this genus should the name be held to be valid by other workers, either now or at any future date. In taking this action they wish to meet the possibility of their interpretation of the rules in regard to the 'Histoire abrégée des Insectes' being rejected by other workers, who will have to recognize *Tettigonia* F. as a valid genus.

This type selection will make *Tettigonia* F. (if considered as a valid genus) a synonym of *Cicada* L. (type *plebeja* Scop. designated by Latreille, 1810).

Horváth, 1926 (Ann. Mus. Nat. Hung. xxiii. p. 94), rejecting Latreille's type fixation, has cited *Cicada orni* L. 1758, as the type of *Cicada* L., and has placed *Cicada plebeja* Scop. 1763, in *Lyristes* Horváth.

In view of Opinions 11 and 79, Horváth's contention cannot be upheld: *Lyristes*, type *Cicada plebeja* Scop., must be suppressed as a synonym of *Cicada* L. 1758 (syntypical), while *Cicada orni* L., which is not congeneric with *Cicada* L., must fall under the next available name, which is *Tettigia* Kolenati, 1857 (subgenus), Stål, 1861 (genus), with haplotype, *C. orni* L.

In 1904 Jacobi (Zool. Jahr. Syst. xix. p. 778) stated that *Tetigonia* Geoffroy was invalid on two grounds (*a*) because it was a homonym, and (*b*) because Geoffroy did not use

binary nomenclature. In consequence, he distinctly proposed *Tettigoniella* as a *nomen novum* in its stead. He fixed no type for *Tettigoniella*, being under the mistaken impression that *Cicada viridis* L. was the type of *Tetigonia* Geoffroy, as he wrote: "Wenige Jahre später gebrauchte Geoffroy (s. o.) dieselbe Bezeichnung in der Schreibung *Tetigonia* für *Cicada viridis* L." This statement is quite erroneous (as *viridis* was not included by Geoffroy under the original description), and neither constitutes a type fixation for *Tettigoniella*, nor under Article 30 *e* (*a*) does it fix *viridis* as the type of *Tetigonia*. Jacobi then lists two species of *Tettigoniella* (*T. nigrinervis* Stål, and *T. albida* Sign.).

The position in 1904 was that Jacobi had proposed a genus without designation of its type as a *nomen novum* for another genus also without type. The species included under *Tetigonia* Geoffroy, comprised *Cicada aurita* L., *C. cornuta* L., and *Membracis genista* F.; the species included under *Tettigoniella* comprised these three, with two other species, *T. nigrinervis* Stål, 1866, and *T. albida* Sign. 1853, also *C. viridis*, through Jacobi's assumption that *C. viridis* was the type of *Tetigonia*. It is laid down in Article 30 of the International Code that in fixing the types of genera the rules *a-g* must be applied in the order of precedence in which they are listed. Rule *e* (*α*) states that species which were not included under the generic name at the time of its original publication are excluded from consideration in determining the types of genera. This means that the type of *Tetigonia* is to be selected only from *C. aurita* L., *C. cornuta* L., and *Membracis genista* F. As *Tettigoniella* Jac. was proposed definitely as a *nomen novum* for *Tetigonia* Geoff., without designation of type, its type must also be one of the above species. This interpretation of Article 30 is supported by the following extract from Opinion 46: "no species unavailable as type in connection with the earlier generic name is available as type in connection with the later generic name" (Smith. Pub. 2060, p. 106). Moreover, by Opinion 35, in the case of the renaming of a genus the original species of the genus named are to be construed as mentioned under the newly proposed name, regardless of the fact whether or not specific combinations for these have been made. We have already fixed *C. aurita* L., as the type of *Tetigonia* Geoff. By Article 30 *f*. this type *ipso facto* becomes the type of *Tettigoniella* Jac., which was proposed as a substitute for *Tetigonia* Geoff.

To avoid confusion we wish to emphasize the fact that *Tettigoniella* was proposed without description definitely as a *nomen novum* for *Tetigonia* Geoff. It cannot therefore be regarded as a genus created separately with a wider range of species from which a type could be selected. The designation of *C. viridis* as its type by Distant in 1903, is therefore invalid, as *C. viridis* is not available as type in connection with any new name for *Tetigonia* Geoff. by Article 30 c (α).

It remains now to provide a generic name for the reception of *Cicada viridis* L., for which no name is available, as *Cicaulella* Latr. 1817 (logotype *C. viridis* L., designated by Van Duzee, 1917), is preoccupied by *Cicaulella* Dumeril, 1806 (haplotype *C. vittata* L.), *Amblycephalus* Curtis, 1833, is preoccupied in Reptilia by *Amblycephalus* Kuhl, in Férussac, 1826, and *Ishidella* Matsumura, 1912*, is not congeneric. We now propose **Tettigella** for the reception of *C. viridis* L., which is designated as its type.

The synonymy created by the present changes is as follows:—

Family Jassidæ.

Tetigonia Geoff. 1762 (type *Cicada aurita* L. 1758).

|| *Ledra* F. 1803.

|| *Tettigoniella* Jac. 1904.

Family Cicadidæ.

Cicada L., 1758 (type *C. plebeja* Scop.).

|| *Tettigonia* F. 1775.

|| *Lyristes* Horvath, 1926.

The other nomenclatorial changes include the restoration of **Tettigla** (Kol.) Stål (type *C. orni* L.), and the proposal of a new genus, **Tettigella** China & Fennah, with type *C. viridis* L. By the above dispositions the only

* The genus *Ishidella* Matsumura, 1912 (Annot. Zool. Japan, viii. p. 41), haplotype *Tettigonia albomarginata* (Signoret, 1853) Matsumura, is not congeneric with *Cicada viridis* L. It differs in the venation, structure of head, etc. The Japanese and Formosan species, identified by Matsumura as *Tettigonia albomarginata* Sign. and on which *Ishidella* was really based, is specifically distinct from the Australian and New Guinea *T. albomarginata* Signoret, 1853, differing in the shape of the head and the colour-pattern of the head and pronotum. In these circumstances *Ishidella* is not available as a name for the generic concept which we have named **Tettigella** (type *Cicada viridis* L.), although Melichar regards *Tettigonia albomarginata* Signoret as a species of *Cicaulella* Latreille. *Ishidella* Matsumura is of course available for a number of Oriental species hitherto placed under *Tettigoniella* Jacobi.

nomenclatorial change in Hemiptera which would result from any future invalidation of *Tetigonia* Geoffroy or from any validation of *Tettigonia* L. (Orthoptera), would be the restoration of the generic name *Ledra*.

Iassus was erected by Fabricius in 1803 (Syst. Rhyng. p. 85) for a number of species without designation of type (the Fabrician descriptive usage followed by Kirkaldy and Van Duzee being here held invalid), and Fallen, in 1826, fixed *Cicada lanio* L. (one of the originally included species) as the genotype (Hem. Suec. Cicad. p. 58). In 1833 Germar erected a genus *Bythoscopus* (Silb. Rev. Ent. i. p. 180) for *Jassus lanis* (sic), *fulgidus*, *flavicollis* Fabr., and other species, and in 1835 Lewis fixed *Jassus lanio* Fabr. (Ent. Syst. iv. p. 38, no. 50) as the type (T.E.S. Lond. i. p. 48, footnote). *Bythoscopus* is thus syntypical with *Iassus*, and must be suppressed as a synonym. *Iassus lanio* Fabr. has the same description as *Cicada lanio* L. (1761, Faun. Suec. p. 892), and Fabricius gives the Linnean reference Syst. Nat. 2, p. 710, no. 37 (i. e., ed. 12, tom. i. part 2). There is thus no doubt that *Iassus lanio* F. 1803 (*lanis* Germar's misprint) is identical with *Cicada lanio* L. 1761. The transference of the name *Bythoscopus* Germ. as a synonym of *Iassus* F., means that *Jassus* auctt. (type *Cicada nervosus* Fabr. 1803) must take the next available name, *Cælidia* Germar, 1821 (Mag. Ent. iv. p. 38, no. 75).

It should be noted that Fabricius' original spelling of *Jassus* was *Iassus*, and although the same symbol is used in latin to represent a capital I or a capital J, the generic and family names should, strictly speaking, be *Iassus* and *Iassidæ* respectively. The use of J instead of I was first made by Germar (Reise Dalmatia) in 1817. He was followed by Fallen (1826).

The synonymy created by the above changes is as follows:—

Iassus Fabr. 1803 (type *Cicada lanio* L. 1761).

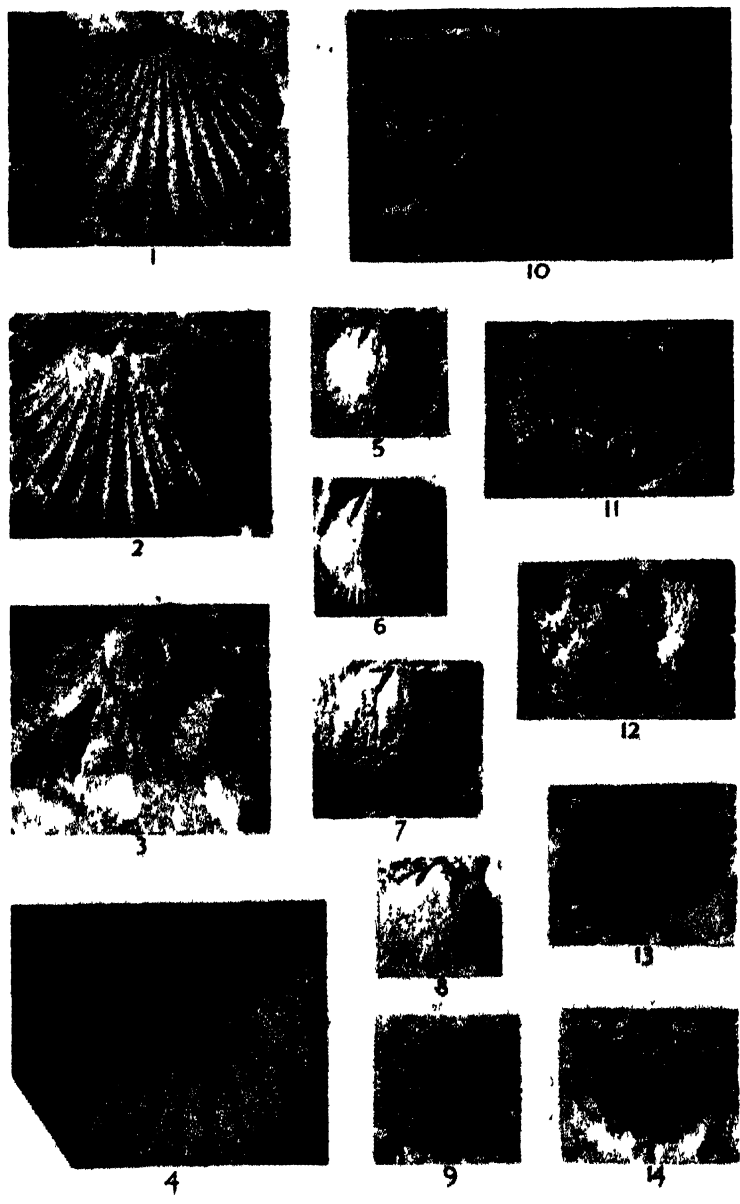
Jassus Fallen, 1826.

|| ***Bythoscopus*** Germar, 1833.

Cælidia Germar, 1821 (type *Cælidia venosa* Germ. by present designation).

|| ***Jassus*** Germar, 1833, et auctt. nec Fabricius.

The authors wish to acknowledge the help received from Dr. P. W. Oman in this problem, and this paper is, in fact, the outcome of correspondence between Dr. Oman and the senior author.



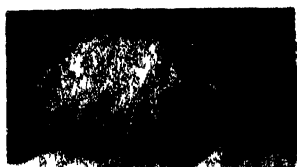
A. L. and D. L. F. G. photo.

Dolerorthis, Mendacella, and Leptana.



A. I. photo.

**Dolerorthis, Platystrophia, Stricklandia,
Merciella, and Plectodonta.**



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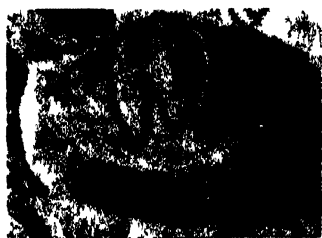
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10

A. L. photo.

Brachypirion.



1



3



2



6



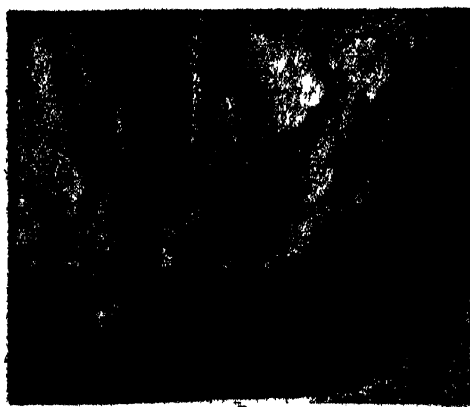
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A. I. photo.

Brachyprion and Camarotoechia.



1



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11



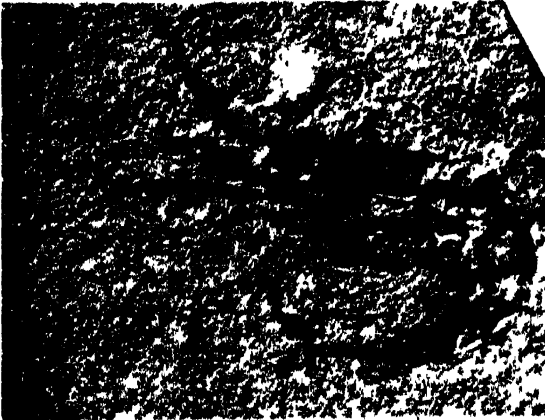
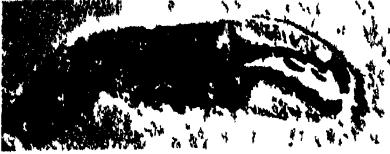
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A L photo

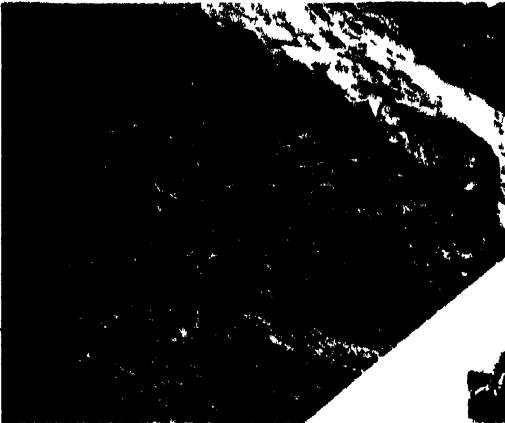
**Brachyprion, Stegerhynchus (?), Camarotoechia,
and Crispella.**



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H G Herring photo

LEBANON CRETACEOUS CRUSTACEA.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY.

[ELEVENTH SERIES.]

No. 95. NOVEMBER 1945.

LXXII. —*A Synopsis of the Peruvian Species of Cyllæpus Er. (Coleoptera, Elmidae).* By H. E. HINTON, Ph.D.,
Department of Entomology, British Museum (Natural History).

ONLY two species of *Cyllæpus* have been recorded from Peru, *C. araneolus* (Müller, 1806) and *C. palpalis* Hinton (1937). In the collections now at hand there are 10 species and one subspecies, as follows :—

(1)	<i>Cyllæpus drymus</i> , sp. n.	1
(2)	„ <i>atys</i> , sp. n.	1
(3)	„ <i>ulpianus</i> , sp. n.	1
(4)	„ <i>palpalis palpalis</i> Hint.	2
(5)	„ <i>palpalis tros</i> , subsp. n.	2
(6)	„ <i>caicus</i> , sp. n.	92
(7)	„ <i>gnidus</i> , sp. n.	1
(8)	„ <i>silius</i> , sp. n.	10
(9)	„ sp. n. (Dept. de Junin)	1
(10)	„ sp. n. (Dept. de Huanuco)	1
(11)	„ sp. n. (Dept. de Huanuco)	1

Total number of specimens examined . . . 113

Three new species, which are related to *C. palpalis* Hint. but have the middle of the pronotal disk punctate instead of granulate, are not named, as each is represented

only by a single female, and all belong to a difficult group of the genus. Three other species, which are also represented by single females, are described, as each is only remotely related to any of the known members of the genus. The descriptions of *C. araneolus* (Müll.) are too brief to show more than that it belongs to the fairly extensive group of species which have the apical segment of the labial palp of the male strongly dilated. *C. araneolus* may thus be *C. palpalis* Hint., *C. caicus*, sp. n., *C. silius*, sp. n., or some other species not represented in the collections I have examined.

A Key to the Peruvian Species of Cylloepus.

1. Elytral epipleura without tomentum except for a very narrow strip near metasternum and abdomen. Pronotum granulate and between granules everywhere densely, evenly reticulately alutaceous *Cylloepus drymus*, sp. n.
- Elytral epipleura entirely tomentose except at extreme apex and base. Pronotum granulate or punctate, but if granulate not densely and reticulately alutaceous between granules 2.
2. Middle discal region of pronotum with numerous distinct granules 3.
- Middle discal region of pronotum without granules 6.
3. Elytra with fourth interval subcarinate on about basal seventh, where it is nearly as strongly raised as third. (Second elytral interval on basal seventh only slightly less convex than third and fourth intervals.) *Cylloepus atys*, sp. n.
- Elytra with fourth interval flat 4.
4. Pronotum with median impression only slightly shallower at base than at middle; disk with coarse flat-topped granules very densely and evenly distributed. Middle tibia with antero-ventral fringe of tomentum less than twice as long as tibia is broad. (Antenna unicolorous. Base of pronotum with median elevation very much broader than scutellum. Elytra with third interval strongly carinate and distinctly curved inwards towards base) ... *Cylloepus ulpianus*, sp. n.
- Pronotum with median impression if present on basal fourth very much shallower than at middle of disk; disk with granules unevenly distributed and not flat-topped. Middle tibia with antero-ventral fringe of tomentum

- more than twice as long as tibia is broad 5.
5. Antenna unicolorous [*palpalis* Hinton (1937).
Cyllæpus palpalis
[subsp. n.
Cyllæpus palpalist ros,
- Antenna bicoloured 6. Abdomen with a broad and distinct depression on apex of fifth abdominal sternite. (Male with a dense brush of erect hairs on each side of disk of second abdominal sternite, and with long, pale, testaceous, erect hairs on ventral apices of four basal segments of front tarsi) *Cyllæpus caicus*, sp. n.
- Abdomen without a depression on apex of fifth sternite 7.
7. Elytra with fourth interval distinctly convex near base; third nearly twice as strongly raised as inner sublateral carina; granules of basal area of elytral disk nearly twice as coarse as facets of eyes. Pronotum with sublateral carina very deeply interrupted at basal two-fifths *Cyllæpus gnidus*, sp. n.
- Elytra with fourth interval flat near base; third not quite as strongly elevated as inner sublateral carina; granules of basal area of elytral disk no coarser than facets of eyes. Pronotum with sublateral carina only shallowly interrupted at basal two-fifths *Cyllæpus silius*, sp. n.

Cyllæpus drymus, sp. n.

Female. - Length, 2.4 mm.; breadth, 1.12 mm.

Body subparallel, moderately convex. Cuticle moderately shining, elytra strongly shining; moderately pale reddish brown with sides of elytra darker and head and eyes black. *Head* with round prominent granules which are about as coarse as facets of eyes and are usually separated by one to two diameters; surface between granules with a dense and very even reticulate microsculpture. Clypeus sculptured like head. *Pronotum* with broadest point, which is at about basal two-fifths, broader than long (0.85 : 0.76 mm.), and base nearly half again as broad as apex (0.81 : 0.57 mm.). Sides nowhere distinctly sinuate. Lateral margins strongly and regularly crenate. Sublateral carinae extending from base to apex, prominent, broad on middle half, inner margins sharp on basal fourth but elsewhere not so distinct, and scarcely noticeably interrupted behind basal two-fifths by oblique impressions. Disk with median longitudinal impression extending from

near base (where it is very shallow) to apical two-fifths and on middle of disk moderately deep and nearly as broad as scutellum but not sharply defined at sides; on basal sixth this channel is on a broad, low, median longitudinal elevation; oblique basal depression on each side shallow but distinct. Surface of disk sculptured like head but with granules slightly finer and usually separated by two to three diameters; surface between granules everywhere densely, reticulately alutaceous like surface of head; sides between sublateral carinæ and lateral margins with granules as coarse as those of head but sparser. *Elytra* parallel-sided, scarcely noticeably broader at apical two-fifths than across humeri. Apices moderately produced and broadly, conjointly rounded. Epipleura without tomentum, except for a very narrow fringe adjacent to metasternum and abdomen. Lateral margins slightly more sparsely but much more sharply crenate than those of pronotum. Sublateral carinæ prominent, inner extending to about apical fifth and outer to about apical eighth, but outer obsolete on basal sixth. Intervals with second and fourth feebly but distinctly convex for a short distance at base; fifth very feebly convex for a very short distance near base; and third subcarinate on about basal sixth or seventh. Surface of intervals feebly and sparsely rugulose, with sparse microscopic punctures, and with numerous granules as coarse as those of pronotal disk but nowhere with a reticulate microsculpture. Discal striæ on basal half feebly to moderately impressed and with very deep, round to subquadrate punctures which are often as broad as intervals and are usually separated longitudinally by one diameter. *Scutellum* flat, obovate, longer than broad (0.12 : 0.09 mm.), and surface reticulately alutaceous but not granulate. *Prosternum*, when seen from side, with anterior three-fifths (not including process) abruptly and rather strongly bent ventrally; sublateral carinæ broad, very prominent, and confined to basal two-fifths. *Hypomera* with granules slightly coarser than those of sides of pronotum, and usually separated by two to four diameters; surface everywhere with a dense, even, reticulate microsculpture. *Metasternum* with median longitudinal line complete, on posterior three-fourths broad and moderately deep; disk very broadly and shallowly concave on each side, entirely tomentose, and

with granules nearly twice as coarse as facets of eyes and separated by one to two diameters. *Abdomen* with disk of first sternite shallowly depressed; sublateral carinæ broad, indistinct, and not attaining hind margin of segment; fifth sternite, when seen from side, evenly sloping to apical margin. *Legs* with a single fringe of tomentum on front and hind tibiæ and two fringes on middle tibia. Front tibia with antero-ventral fringe extending from apex nearly to middle. Middle tibia with antero-ventral fringe only half again as long as tibia is broad and separated from apex by a distance equal to its breadth, postero-ventral fringe extending from apex nearly to middle. Hind tibia with tomentose fringe extending from basal two-fifths nearly to apex.

Male.—Unknown.

Type.—A female in the British Museum (Nat. Hist.). Peru: Junin, Satipo, Sani Beni, alt. 780 m. 1935 (*F. Woytkowski*).

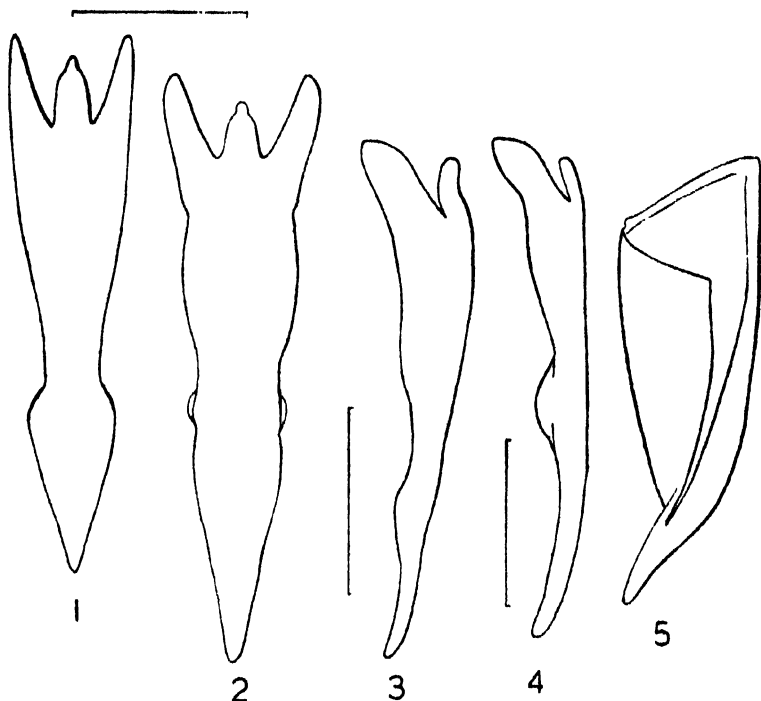
Comparative Notes.—The only other continental American species which has the elytral epipleura nearly entirely free of tomentum is *C. olenus* Hint. (1945). The latter is the only species of the genus known from low altitudes in the Amazon basin. I have taken it near the origin of the Rio Madeira, at Manaos, above the junction of the Rio Negro and Solimoes, at the mouth of the Amazon, and in the coastal area of French Guiana. Both of these species are related to *C. lahottensis* (Darl., 1936) of Haiti and *C. quadrata* (Darl., 1927) of Cuba, two species which also have the elytral epipleura nearly entirely free of tomentum. *C. drymus* is much smaller than *C. olenus* (2.4:3.2–4.2 mm. long); it has a shorter and much shallower median pronotal impression; the surface between the pronotal granules is very densely and evenly reticulate instead of irregularly punctate, and there are no strongly shining nearly smooth basal areas as in *C. olenus*; the scutellum is much longer than broad instead of as broad as long, and its surface is densely reticulate instead of nearly smooth; and the third elytral interval is only subcarinate instead of strongly carinate near its base. Both *C. drymus*, sp. n. and *C. olenus* Hint. may be distinguished from the two West Indian species by having a fringe of tomentum on the hind tibia.

Cyllopus atys, sp. n. (Figs. 1, 3, and 5.)

Male.—Length, 3.5 mm.; breadth, 1.4 mm.

Body subparallel and moderately convex. Cuticle shining, black to very dark rufo-piceous with antennæ, mouth-parts, and tarsi paler rufo-piceous. *Pronotum* with broadest

Figs. 1-5.



- (1) Median lobe of male genitalia of *Cyllopus atys*, sp. n. (2) Same of *C. tuberculatus* Hint. (3) Lateral view of median lobe of *C. atys*, sp. n. (4) Same of *C. tuberculatus* Hint. (5) Inner view of right paramere of male genitalia of *C. atys*, sp. n. Lines next to these and other figures refer to a length of 0.20 mm.

point, which is at basal two-fifths, very slightly broader than long (1.12 : 1.09 mm.) and base broader than apex (1.01 : 0.82 mm.). Sides broadly and scarcely noticeably sinuate before base. Lateral margins feebly, moderately regularly crenate. Sublateral carinæ prominent (particu-

larly on middle two-thirds, where they are also broader), extending from base to apex, inner margins sharp, and broadly shallowly interrupted by oblique impressions behind basal two-fifths. Disk with median longitudinal impression deep, at middle nearly as broad as scutellum but slightly narrower elsewhere, and extending from base to about apical seventh; impressions near base on each side of scutellum oval and about half as broad as scutellum; disk in front of scutellum on basal third with sides of median channel broadly convex and very prominent; oblique impression on each side broad and very shallow. Surface of middle of disk with round to irregularly shaped granules which are slightly coarser than facets of eyes, and are nearly confluent to separated by nearly one diameter; surface between granules microscopically rugose-punctate; anterior middle fourth of disk with granules slightly sparser and surface between smooth or nearly so; surface on basal third to two-fifths between sides of median channel and sublateral carinae with granules, separated by one to three diameters, and surface between them strongly shining and more or less smooth; surface between sublateral carinae and lateral margins sculptured on about posterior half like latero-basal part of disk and on anterior half like antero-lateral sides of disk but more coarsely granulate. *Elytra* at about apical two-fifths slightly but distinctly broader than at humeri. *Epipleura* densely tomentose. Lateral margins crenate like margins of pronotum but slightly more finely so. Sublateral carinae with inner more prominent on basal two-thirds but outer more prominent apically; inner extending a little nearer apex than outer but here only very feebly convex. Intervals with second, third, and fourth moderately strongly convex or subcarinate on basal seventh, but all flat at extreme base; on basal seventh second less convex than third and fourth, and third very slightly more convex than fourth, which extends nearly to apical two-fifths as a ridge; fifth interval flat. Surface of intervals feebly and sparsely rugose, microscopically punctate, and everywhere, except on middle apical third to three-fifths, with numerous round granules slightly coarser than facets of eyes. Striae everywhere deep and moderately broad; strial punctures on basal part of disk deep, round to subquadrate, one-third to two-thirds as broad as intervals,

and separated longitudinally usually by one and a half diameters. *Scutellum* flat, obovate, longer than broad (0.20 : 0.14 mm.), and surface with a few indistinct granules. *Prosternum*, when seen from side, with anterior two-thirds (not including process) abruptly and moderately strongly bent ventrally; without distinct sublateral carinæ. *Metasternum* with disk flat or scarcely noticeably concave and densely coarsely granulate. *Abdomen* with disk of first sternite deeply depressed; sublateral carinæ broad, low, and not quite reaching hind margin. Fifth sternite, when seen from side, evenly sloping to apical margin and with a broad, extremely shallow, very indistinct median longitudinal impression. *Legs* with a single fringe of tomentum on front and hind tibiæ and two fringes on middle tibia. Front tibia with tomentose fringe extending from near apex to basal three-fifths. Middle tibia with antero-ventral fringe confined to apical third, and postero-ventral fringe extending from very near apex to basal two-fifths. Hind tibia with postero-ventral fringe extending from near apex to basal two-fifths.

Female.—Unknown.

Type.—A male in the Museum of Natural History, Paris. Peru: Prov. Huallaga, Tocache, alt. 500 m., x-xi, 1900 (G. A. Baer).

Comparative Notes.—This can only be compared to *C. tuberculatus* Hint. (1940) of Bolivia. It is smaller than *C. tuberculatus* (3.5 : 4.0–4.5 mm. long), but the few minor external differences that have been noted between the two will almost certainly prove to be individual rather than specific when larger series of both are examined. The differences in the male genitalia, and particularly in the structure of the median lobe (see figs.) between the two, are too great to justify calling the Peruvian form a subspecies of *C. tuberculatus*.

Cyllocpus ulpianus, sp. n.

Female.—Length, 3.6 mm.; breadth, 1.37 mm.

Body subparallel with dorsal surface only feebly convex. Cuticle shining and dark rufo-piceous to nearly black with antennæ (unicolorous), mouth-parts, and tarsi paler. *Head* with round prominent granules which are as coarse as facets of eyes and are usually separated by one to two diameters; surface between granules very densely and

evenly microscopically punctate. Clypeus sculptured like head. *Pronotum* with broadest point, which is at about basal third, as broad as long (1.04 mm.) and base broader than apex (1.01 : 0.74 mm.). Sides broadly and shallowly but distinctly sinuate before base. Lateral margins feebly but rather regularly crenate. Sublateral carinae extending from base to apex, moderately prominent, broad on middle two-thirds, inner margins sharp (particularly on basal third), and sinuate at basal two-fifths but here scarcely depressed by oblique impressions. Disk with median longitudinal impression complete and at middle but little broader than at base; sides of median impression not sharply defined; oblique basal impression broad and shallow; median basal ridge (containing median impression) at base half again as broad as scutellum and at a distance from base equal to length of scutellum the ridge is twice as broad as scutellum. Surface of disk with round or oval, flat-topped, setiferous granules which are nearly twice as coarse (0.02 mm.) as facets of eyes and are seldom separated by more than two-thirds of one diameter; surface between granules densely, microscopically punctate; basal third between median ridge and sublateral carina strongly shining and nearly smooth; sides between sublateral carinae and lateral margins with granules less flat-topped and much sparser than those of disk, and surface on basal third often smooth and strongly shining. *Elytra* nearly parallel-sided, very slightly broader behind basal three-fifths than across humeri. Apices moderately produced and broadly, conjointly rounded. *Epiploura* entirely tomentose except at basal and apical tenth. Lateral margins very feebly but regularly crenate. Sublateral carinae prominent, inner extending to apical fourth and outer to about apical sixth, but outer obsolete at humeri. Intervals flat or nearly so except for third which is very prominently carinate on basal sixth and is distinctly curved inwards towards base; second interval twice as broad as first for a short distance behind scutellum. Surface of intervals with numerous granules which are not as flat-topped nor as dense (except on carinate intervals) as those of pronotal disk; towards apex and sides these granules become finer and much sparser; surface between granules feebly, sparsely rugulose, and with a few microscopic punctures. Discal striae on basal half feebly

impressed (second stria obsolete opposite carinate part of third interval) and with moderately shallow, round to subquadrate punctures which are usually one-third to one-half as broad as intervals and are generally separated by one to two diameters. *Scutellum* flat to very feebly concave, obovate, longer than broad (0.16 : 0.12 mm.), and surface nearly smooth. *Prosternum*, when seen from side, with anterior two-thirds (not including process) moderately abruptly and moderately strongly bent ventrally; sublateral carinae indistinct, confined to basal third. Hypomeron with basal three-fourths sparsely, irregularly granulate, and surface between granules strongly shining and smooth; anterior fourth densely rugosely granulate. *Metasternum* with disk nearly flat on either side of the nearly complete median impressed line; surface entirely tomentose and with low, flat-topped granules as coarse as those of pronotal disk but often separated by two diameters. *Abdomen* with disk of first sternite moderately deeply depressed, the anterior fourth of the depression being free of tomentum; sublateral carinae broad and only extending about two-thirds of distance to hind margin. Second sternite at middle of anterior margin with a small oval depression, the surface for a short distance on either side of this depression being non-tomentose. Sternites with granules sparse and seldom as coarse as facets of eyes. Fifth sternite with apical fourth very feebly declivous and non-tomentose. *Legs* with a single fringe of tomentum on front and hind tibiae and two fringes on middle tibia. Front tibia with antero-ventral fringe confined to apical two-fifths. Middle tibia with antero-ventral tomentose fringe slightly less than twice as long as tibia is broad and separated from apex by a distance nearly equal to diameter of tibia; postero-ventral fringe extending from apex nearly to middle. Hind tibia with postero-ventral fringe extending from near apex to basal half.

Male.—Unknown.

Type.—A female in the British Museum (Nat. Hist.). Peru: Huanuco, Leonpampa, alt. 800 m., xii, 1937 (F. Woytkowski).

Comparative Notes.—This species does not resemble any other described member of its genus. It owes its distinctive appearance to its slightly depressed form, complete

but shallow median pronotal depression, coarse and dense flat-topped pronotal granules, very broad median basal pronotal elevation, and its strongly carinate third elytral interval which curves inwards towards the base.

Cylloepus palpalis tros, subsp. n.

Female.—Length, 3.2 mm. ; breadth, 1.23 mm. Externally similar to *C. palpalis palpalis* Hint. (1937) but with the two basal segments of antenna red-brown or brownish testaceous and apical segments dark brownish black, whereas in *C. palpalis palpalis* the antenna is unicolorous.

Male.—Unknown.

Type.—A female in the University of Kansas. Peru : Huanuco, Leonpampa, alt. 800 m., xii, 1937 (*F. Woytkowski*).

Paratype.—A female with the same data in the British Museum (Nat. Hist.).

The female of *C. palpalis palpalis* and the male of *C. palpalis tros* are unknown. *C. p. tros* may prove to be specifically distinct from *C. p. palpalis* when the male of the former is found and its genitalia can be examined. The male genitalia of *C. palpalis palpalis* have already been figured (Hinton, 1937, figs. 13, 15, and 16).

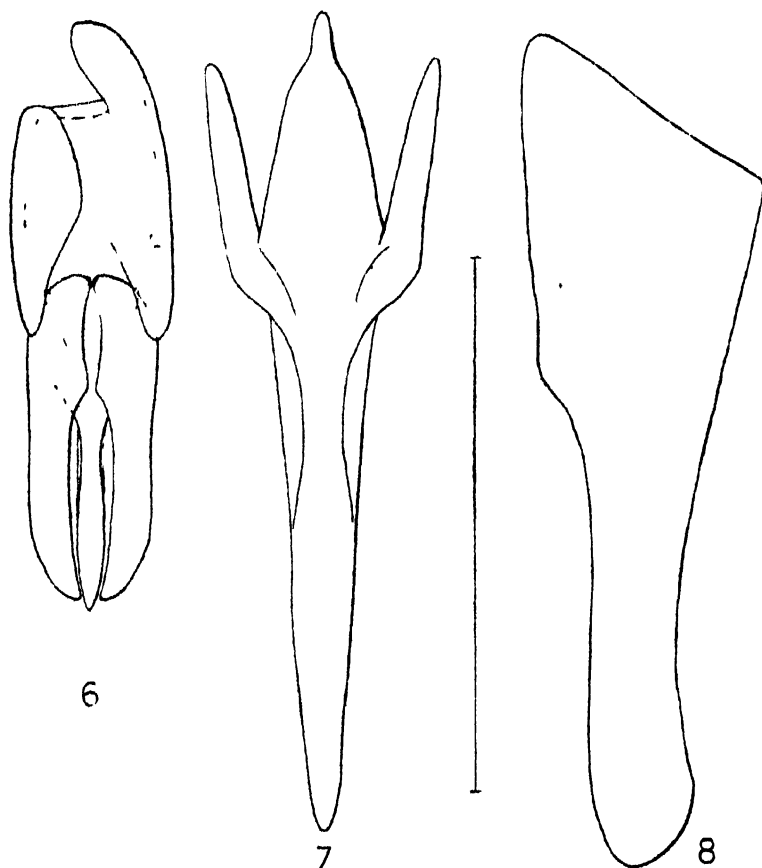
Cylloepus caicus, sp. n. (Figs. 6–8.)

Male.—Length, 3.0–3.4 mm. ; breadth, 1.12–1.26 mm.

Body subparallel, moderately convex. Cuticle shining and dark brownish piceous to nearly black ; two basal segments of antennæ, mouth-parts, tarsi, and often much of ventral surface paler and rufo-piceous ; head black, two basal segments of antenna sometimes brownish testaceous. *Head* with round granules nearly as coarse as facets of eyes and usually separated by two to three diameters ; surface between granules densely, microscopically punctate. Clypeus sculptured like head but near anterior margin, with the microscopic punctures sparser. *Pronotum* with broadest point, which is at about basal two-fifths, not as broad as long (0.79 : 0.90 mm.) and base broader than apex (0.76 : 0.65 mm.). Sides not sinuate before base but very broadly, shallowly, distinctly sinuate at apical third. Lateral margins feebly, regularly crenate. Sublateral carinæ extending from base to apex, moderately prominent (particularly on middle two-thirds where they are broad), inner margins sharp, and carinæ

sinuate and very shallowly impressed at basal two-fifths by oblique impressions ; on apical third at middle (apical fourth at sides) there is a very shallow but usually distinct

Figs. 6-8.



Cyllaspus caicus, sp. n.

(6) Dorsal view of male genitalia. (7) Dorsal view of median lobe dissected out. (8) Outline of inner view of left paramere.

transverse impression which is interrupted by the median discal channel and on each side by the sublateral carina. Disk with median impression extending from base nearly

to apical fourth, on middle half of disk deep, narrowly obovate, and broadest point equal to diameter of scutellum; on basal fourth this impression is narrow, parallel-sided, and very shallow, and the median basal ridge is moderately strongly raised, nearly parallel-sided, and as broad as scutellum; oblique basal impressions shallow except on inner side of sublateral carinae where they are deep. Surface of middle of disk with round to irregularly shaped punctures which are half again to twice as coarse as facets of eyes, and are confluent to separated by one diameter, but in some specimens most punctures are confluent so that surface is rugosely punctate; surface between coarse punctures usually smooth; bottom of median channel with numerous microscopic punctures; some specimens with surface of sublateral carinae and extreme anterior sides with a few low granules; basal sides between median impression and sublateral carinae and between the latter and lateral margins very strongly shining and only with an occasional puncture. *Elytra* at apical two-fifths slightly but very distinctly broader than at humeri. Apices moderately produced and broadly, conjointly rounded. Lateral margins on basal three-fifths more distinctly crenate than margins of pronotum; on apical two-fifths only indistinctly crenate. *Epipleura* entirely tomentose except at extreme base and apex. Sublateral carinae prominent, inner extending from base to slightly beyond apical third and outer from behind humeral callosity to about apical sixth. Intervals with third strongly and broadly carinate on basal seventh and second feebly and broadly convex for a short distance behind scutellum, where it is twice as broad as first; other intervals flat or nearly so, the few granules on extreme base of fifth sometimes giving this interval the appearance of being feebly convex. Surface of intervals sparsely, microscopically punctate, and near base with a few sparse granules which are about as coarse as facets of eyes; elevated intervals densely granulate as usual in the genus. Discal striae on basal half only feebly impressed but first deeply impressed at extreme base; stria punctures very deep, round to subquadrate, and usually nearly as broad as intervals, and separated longitudinally by about one diameter; punctures of fourth stria often joined to those of fifth stria. *Scutellum* flat, obovate, longer than broad

(0.14 : 0.11 mm.), and with surface granulate. *Prosternum*, when seen from side, gradually and moderately strongly bent ventrally from base (not including process) or basal one-fourth ; sublateral carinae indistinct and confined to basal fourth or absent. Hypomera with middle two-fifths very sparsely granulate and strongly shining ; apical and basal region rugose and with numerous microscopic punctures. Metasternum with median longitudinal line moderately deep, and nearly as broad as basal tarsal segment on posterior two-thirds but obsolete anteriorly ; disk completely tomentose and broadly and shallowly concave on either side of median line ; surface with round, nearly flat-topped granules which are about half again as coarse as facets of eyes and are separated by less than one to slightly more than one diameter. *Abdomen* with disk of first sternite very deeply depressed and surface of anterior half of depressed area not tomentose ; sublateral carinae prominent and complete. Disk of second sternite with a broad and shallow depression which becomes narrower and shallower posteriorly and is obsolete at about posterior fourth ; at anterior two-fifths on each side of depression with a short, thick, nearly erect brush of golden hairs. Fifth sternite with a broad, oval, deep, shining, non-granulate, flat-bottomed depression occupying middle anterior third of sternite. *Legs* with a single fringe of tomentum on front and hind tibiae and two fringes on middle tibia. Front tibia with antero-ventral tomentose fringe extending from apex to basal two-fifths. Middle tibia with antero-ventral fringe confined to apical third and postero-ventral fringe extending from near apex to basal two-fifths ; inner or ventral surface with five to ten fine teeth forming a row which extends from apex to about basal four-fifths. Hind tibia with postero-ventral fringe of tomentum extending from near apex to basal two-fifths. Front tarsus with numerous long, pale testaceous hairs near ventral apex of each of four basal segments.

Female.—Externally similar to male except as follows:—(1) apex of apical segment of labial palp not very strongly broadened as it is in the male ; (2) second abdominal sternite only very shallowly depressed close to middle anterior margin instead of depressed to posterior fourth, and without trace of erect hair-brushes ; (3) apical

depression of fifth abdominal sternite narrow, three times as long as broad instead of less than twice as long as broad; (4) inner (ventral) apex of middle tibia without a row of fine teeth; and (5) front tarsi without long, erect, pale testaceous hairs on ventral apices of four basal segments.

Type. A male in the University of Kansas. Peru: Huanuco, Leonpampa, alt. 800 m., xii, 1937 (*F. Woytkowski*).

Paratypes.—48 males and 43 females with same data as type but some in the collection of the British Museum.

Comparative Notes.—This is very closely related to *C. optatus* Sharp, from which the male may be readily distinguished by not having the hind tibia conspicuously swollen in apical half. The female differs from that of *C. optatus* in having the apical depression of the fifth abdominal sternite deep, narrow, and sharply circumscribed instead of very shallow and indefinitely limited.

Cylloepus gnidus, sp. n.

Female.—Length, 3.4 mm.; breadth, 1.31 mm.

Body subparallel, moderately strongly convex. Cuticle feebly shining and black, with antennae, mouth-parts, and tarsi brownish testaceous or rufo-piceous, the two basal segments of the antennae being very slightly paler than the apical; legs and much of ventral surface dark rufo-piceous. *Head* with round, low granules as coarse as facets of eyes to half again as coarse and separated by one to two diameters; surface between granules densely, microscopically punctate and rugulose. Clypeus sculptured like head but with the granules finer, less distinct, and occasionally oblong instead of round. *Pronotum* with broadest point, which is slightly before basal third, broader than long (0.99:0.90 mm.), and base broader than apex (0.90:0.71 mm.). Sides very broadly and very shallowly sinuate at apical third and shallowly but more distinctly sinuate before base. Lateral margins very feebly crenate. Sublateral carinae extending from base nearly but not quite to apex, prominent, inner margins sharp, and broadest behind and before basal third, where they are very deeply but not completely interrupted by oblique impressions. Median longitudinal impression extending from basal fourth to apical fifth or sixth, deep, at middle as broad as scutellum, and boat-shaped with sides

well marked; median basal ridge in front of scutellum moderately prominent, flat-topped, and immediately in front of base slightly narrower than scutellum; oblique basal impression broad and deep only from basal fourth to outer side of sublateral carina, elsewhere indistinct. Surface of middle of disk with microscopic punctures densely intermixed with punctures nearly as coarse as facets of eyes; bottom of median impression or channel rugose; surface of median basal ridge, sublateral carinae, and sides between sublateral carinae and lateral margins coarsely and rugosely granulate. *Elytra* at apical two-fifths very slightly broader than at humeri. Apices moderately produced and broadly, conjointly rounded. Lateral margins feebly but regularly crenate. Epipleura entirely tomentose except at extreme base and apex. Inner sublateral carina extending to about apical third and narrow and feebly raised; outer extending from behind humeral callosity to about apical sixth and on basal half as low as inner, but on apical half distinctly more elevated. Intervals with third broadly and moderately strongly carinate on about basal fifth or sixth; fourth feebly but distinctly convex for a short distance near base; other intervals flat or nearly so, the second behind scutellum as broad as first (sutural) or only very slightly broader. Surface of intervals near base with dense, round to irregular, nearly flat-topped granules which are nearly twice as coarse as facets of eyes; towards apex these granules become finer, much sparser, and the surface between them more evidently punctate. Discal striae on basal half feebly to moderately impressed; stria punctures very deep, round to subquadrate, two-thirds as broad to broader than intervals, and usually separated longitudinally by less than their diameters. *Scutellum* flat, obovate, longer than broad (0.19:0.14 mm.), and surface with numerous microscopic punctures and a few indistinct granules. *Prosternum*, when seen from side, with anterior three-fourths (not including process) abruptly and moderately strongly bent ventrally; sublateral carinae indistinct, confined to basal fourth. *Hypomera* with surface everywhere coarsely, rugosely sculptured or densely, microscopically punctate, or both. *Metasternum* with median longitudinal line complete; disk with posterior three-fifths broadly, shallowly de-

pressed; surface entirely tomentose and with coarse granules which are often oblong. *Abdomen* with disk of first sternite only declivious from middle to anterior margin; sublateral carinae very short, indistinct or obsolete; surface of disk of this, second, third, and fourth sternites not entirely tomentose. Fifth sternite, when seen from side, evenly inclined to apex and without an apical depression. *Legs* with a single fringe of tomentum on front and hind tibiae and two fringes on middle tibia. Front tibia with antero-ventral fringe extending from near apex to middle. Middle tibia with antero-ventral fringe confined to apical third or very little more; postero-ventral fringe extending from near apex to slightly beyond middle. Hind tibia with postero-ventral fringe extending from near apex nearly to basal third.

Male.—Unknown.

Type.—A female in the collection of the Museum of Natural History, Paris. Peru: Huallaga, Tocache, alt. 800 m., x-xi, 1900 (*G. A. Baer*).

Comparative Notes.—This is not closely related to any other described species of *Cylloepus*. It superficially resembles *C. atys*, sp. n., but the latter has the median pronotal channel extending to the base, the disk densely granulate instead of punctate, the sublateral pronotal carinae complete and not deeply interrupted by the oblique impressions, and the basal striae punctures of the elytra are much finer.

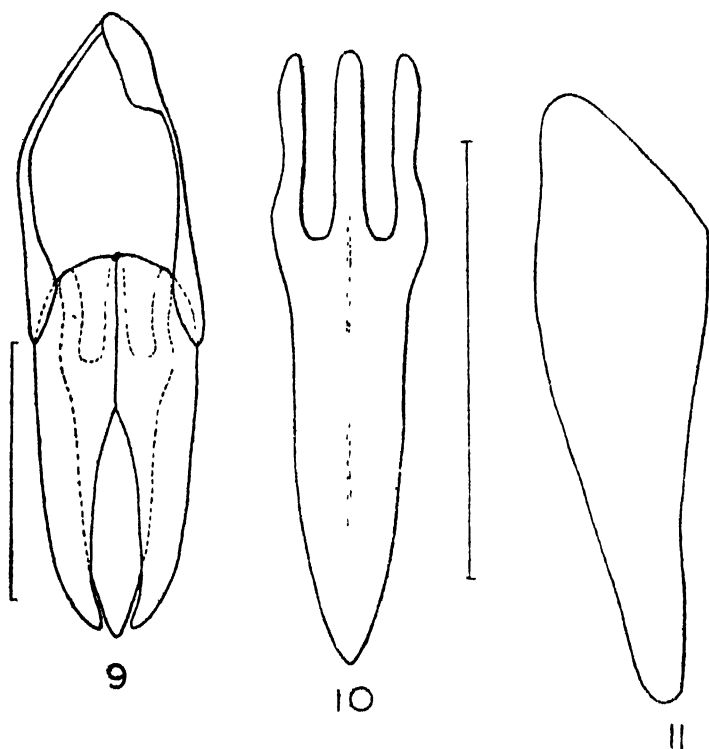
Cylloepus silius, sp. n. (Figs. 9–11.)

Male.—Length, 3.0–3.5 mm.; breadth, 1.01–1.23 mm.

Body parallel-sided and only moderately convex dorsally. Cuticle shining with head black, pronotum black or very nearly black, elytra chestnut-brown, antennae nearly unicolorous or with two basal segments slightly but distinctly paler than apical, mouth-parts dark brownish testaceous, and tarsi rufo-piceous with remainder of legs and often much of ventral surface dark rufo-piceous. *Head* densely, microscopically punctate and with a few low indistinct granules which are slightly finer than facets of eyes; on each of side of middle of head with a small area on which the microscopic punctures are sparse or nearly absent. Clypeus sculptured like anterior part of head. *Pronotum* with broadest point, which is at basal two-fifths,

slightly less than length (0.74 : 0.82 mm.) and base broader than apex (0.68 : 0.64 mm.). Sides broadly and feebly sinuate before base. Lateral margins feebly but regularly crenate. Sublateral carinae extending from base very nearly to apex but indistinct or obsolete on apical tenth, moderately prominent (particularly on middle two-thirds, where they are broadest), inner margins distinct and more

Figs. 9-11.

*Cyllæpus silius*, sp n.

(9) Dorsal view of male genitalia. (10) Dorsal view of median lobe dissected out. (11) Outline of inner view of left paramere.

or less sharp, and sinuate and moderately shallowly interrupted at basal two-fifths by oblique impressions; on apical fourth sublateral carinae are very shallowly impressed by the broad and indistinct transverse apical impression. Disk with median impression or channel

extending from basal to apical fourth, moderately deep at middle where it is slightly broader than scutellum, and with limits distinctly marked; oblique basal impression broad, moderately shallow, distinct; median ridge of basal fourth low, flat-topped to scarcely noticeably concave, and about as broad as, to slightly broader than, scutellum. Surface of middle of disk with shallow punctures slightly finer than facets of eyes and separated by one to two diameters; surface between these punctures nearly smooth; surface of bottom of median channel densely, microscopically punctate; surface of median basal ridge and gibbosity on each side with numerous microscopic punctures and a few low granules; sides between sublateral carinae and lateral margins with round or oval granules which are nearly as coarse as facets of eyes and are separated usually by two to four diameters. *Elytra* at apical two-fifths only very slightly broader than across humeri. Apices broadly, moderately feebly produced and conjointly, very broadly rounded. Lateral margins finely, regularly crenate. Epipleura entirely densely tomentose except at extreme apex and base. Sublateral carinae only moderately elevated; inner extending from base to apical third or slightly beyond and everywhere on basal half more prominent than outer carina, which extends from behind humeral callosity to apical fourth but is very feebly elevated on basal half of its length. Intervals with third on basal seventh more broadly but not quite so strongly elevated as inner carina, and other intervals flat; second about twice as broad as first for a short distance behind scutellum. Surface of intervals feebly and sparsely rugulose, with a few microscopic punctures, and on basal region with numerous round or oval granules which are nearly as coarse as facets of eyes; towards sides and on apical half these granules are more or less entirely replaced by fine punctures. Discal striae on basal half feebly impressed; striae punctures deep, round, one-fourth to two-thirds as broad as intervals, and usually separated longitudinally by one to two diameters. *Scutellum* flat or very feebly concave, obovate, longer than broad (0.14 : 0.11 mm.), and surface with numerous microscopic punctures and a few granules. *Prosternum*, when seen from side, with anterior four-fifths (not including process) gradually and moderately strongly

bent ventrally; sublateral carinae very indistinct or absent. Hypomera on middle half with granules as coarse as facets of eyes, separated by two to three diameters, and surface between strongly shining and nearly smooth or with a few rugae; surface elsewhere rugose and with dense microscopical punctures. Metasternum with median longitudinal line nearly complete to anterior margin and broad and shallow on posterior three-fifths; disk nearly flat, entirely tomentose, and with flat-topped granules half again as coarse as facets of eyes and separated by one to three diameters, with surface between densely microscopically punctate. *Abdomen* with disk of first sternite flat or very shallowly depressed and tomentum confined to posterior third or fourth; sublateral carinae low, inconspicuous, and extending from near hind coxae half-way to hind margin. Fifth sternite evenly inclined to apex, without a depression. Granules of sternites nowhere quite as large as facets of eyes. *Legs* with a single fringe of tomentum on front and hind tibiae and two fringes on middle tibia. Front tibia with antero-ventral tomentose fringe extending from apex to basal two-fifths. Middle tibia with antero-ventral fringe extending from apex to basal two-thirds; postero-ventral fringe extending from apex to slightly beyond middle. Hind tibia with postero-ventral fringe extending from near apex to slightly beyond posterior third.

Female.—Externally similar to male but with the third segment of the labial palp not strongly broadened.

Type.—A male in the British Museum (Nat. Hist.). Peru: Arequipa, Arequipa, alt. 2,300 m., iii. 1937 (H. E. Hinton).

Paratypes.—2 males and 1 female with same data as type, 2 males, Lima, Naña, alt. about 600 m., 19. iii. 1937 (H. E. Hinton, F. Woytkowski), and 2 males and 2 females, Huanuco, Leonpampa, alt. 800 m., xii. 1937 (F. Woytkowski).

Variations.—The colour of the elytra is dark rufopiceous in the specimens from Naña and black in those from Leonpampa. In the examples from Naña and Leonpampa there are a few more or less distinct but sparse granules on the sides of the pronotal disk before the inner sides of the sublateral carinae, whereas in those from Arequipa the same area is only punctate. The single female from Arequipa has the granules of the metasternal

disk no coarser than the facets of the eyes, whereas in the males from Arequipa and all specimens from Naña and Leonpampa these granules are half again as coarse as the facets of the eyes. The specimens from Arequipa have the sparse granules of the abdominal sternites considerably to only slightly finer than the facets of the eyes, but in both males from Naña these granules are as coarse as the facets of the eyes on the middle of the second and third sternites, where they are usually separated by two to three diameters. In the males and females from Leonpampa the granules on the middle of the second and third abdominal sternites are slightly but distinctly coarser than the eye facets and usually separated by less than one to nearly two diameters.

Comparative Notes.—This is closely related to *C. sparsus* Hint. (1940) of Bolivia, from which it may be distinguished as follows :—(1) the basal part of the third elytral interval is subcarinate instead of only feebly convex ; (2) the basal part of the second and fourth elytral intervals is flat instead of feebly but distinctly convex ; (3) the median pronotal channel is not continued to the base ; (4) the middle area of the hypomera is nearly smooth and strongly shining between the granules instead of entirely rugose ; (5) the anterior four-fifths of the prosternum is moderately strongly bent ventrally, whereas in *C. sparsus* the anterior half is only feebly bent ventrally ; and (6) the males have the apical segment of the labial palp strongly broadened. In addition, *C. silius* has relatively longer legs than *C. sparsus*.

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LXXIII.—*New or little-known Tipulidæ (Diptera).*—

LXXVI. *Neotropical Species.* By CHARLES P. ALEXANDER, Ph.D., F.R.E.S., Massachusetts State College, Amherst, Massachusetts, U.S.A.

At this time I am considering a series of crane-flies, chiefly in the genus *Holorusia* Loew, from Ecuador and Peru, where they were collected by my friends and correspondents, Messrs. F. Martin Brown, David Laddey, William Clarke-Macintyre, Pedro Paprzycki, and Felix Woytkowski, to whom virtually all of our recent records and collections in this family have been due. I am deeply indebted to all of the above mentioned gentlemen for their continued interest in these flies. The types of the novelties are preserved in my personal collection.

Holorusia (Holorusia) uniatra, sp. n.

Allied to *lassula*; antennæ yellow, the outer four or five segments infuscated; flagellar segments nearly cylindrical, the terminal one about three-fourths longer than the penultimate; dorsopleural region broadly yellow, the dorsal pleurites infuscated; femora brownish yellow with a nearly terminal blackened ring; wings broad, fulvous, restrictedly patterned with dusky and with a single blackened spot at origin of *Rs*; *Rs* a trifle longer than vein *R*₃; ovipositor with cerci compressed-flattened, the tips obtuse; hypovalvæ very short and obtuse.

Male.—Length about 19–20 mm.; wing 24.5–25.5 mm.; antenna about 4.3–5 mm.

Female.—Length about 23 mm.; wing 27.2 × 7.6 mm.

Frontal prolongation of head reddish brown, sparsely pruinose above, especially basally; nasus elongate, with abundant black setæ; palpi brownish black. Antennæ yellow, the terminal four or five segments infuscated; flagellar segments nearly cylindrical, only the outer two with verticils; terminal segment about three-fourths longer than the penultimate. Head greyish brown, more intense on the anterior vertex and on posterior orbits; a narrow darkened vitta on the vertex.

Pronotum and cervical region clear light yellow, the scutum conspicuously darkened medially. Mesonotal

præscutum chestnut brown, with four slightly darker brown stripes that are again bordered by slightly darker brown; scutum similarly coloured, the areas narrowly ringed with darker brown; scutellum brown, with a narrow median darker line; mediotergite reddish brown, sparsely pruinose, with a capillary median brown line and indications of darker areas on the sides of the sclerite; pleurotergite chiefly golden yellow, the posterior two-thirds of the anapleurotergite more darkened. Pleura with the dorsopleural region light yellow, more widened behind, bordered beneath by a brown stripe that extends from the cervical region backwards over the esepisternum on to the pteropleurite, on the more ventral pleurites somewhat paler. Halteres with stem weakly infuscated, the base obscure yellow; apex of knob paling to obscure orange. Legs with the coxæ yellowed, the fore pair more infuscated; trochanters greenish yellow, the fore pair elongated; femora obscure brownish yellow, with a nearly terminal blackened ring, subequal on all legs, preceded by a slightly clearer yellow annulus; tibiæ and tarsi brownish yellow, the terminal tarsal segments more blackened. Wings broad, with a strong fulvous or brownish fulvous tinge, vaguely patterned with dusky and clearer yellow areas, the latter best evidenced in the bases of cells *Cu* and 1st *A*; prearcular field, outer end of cell 1st *M*₂, marginal tips of outer medial, cubital and anal veins, and the anal border narrowly margined with dusky, the posterior end of *m-cu* somewhat more distinctly darkened; axillary angle dusky; a single small blackened spot over origin of *Rs*, veins yellow, the origin of *Rs* more infuscated. Venation: *Rs* a trifle longer than *R*₃; cell 1st *M*₂ pointed at outer end; petiole of cell *M*₁ a little more than one-half *m*.

Abdominal tergites reddish brown, darker laterally; sternites yellow, the posterior portions of the intermediate segments a trifle darkened. Ovipositor with the cerci castaneous, compressed-flattened, the tips obtuse; hypovalvæ very short and obtuse.

Hab. Peru (Ayacucho, Huanta).

Holotype, ♀, Yanamonte, Ayacucho, in fog-forests, altitude 3000-4100 metres, October 6, 1941 (*Woytkowski*). *Paratopotypes*, 1 ♂, 1 ♀, September 8, 1941; *paratype*, 1 ♂, Huanta, Huanta, 3800 metres, April 18, 1941 (*Woytkowski*).

Holorusia (Holorusia) uniatra is most nearly allied to *H. (H.) flavicornis* Alexander and *H. (H.) lassula* Alexander, differing especially in the broad wings, with distinctive pattern and venational details, and in the structure of the ovipositor. The male specimens were received too late for inclusion in this description.

Holorusia (Holorusia) chimborazo, sp. n.

Antennæ with outer flagellar segments brownish black, nearly cylindrical without verticils; Mesonotal præscutum with four dark grey stripes, the intermediate pair narrowly bordered by darker brown; pleura striped longitudinally with yellow and brown; femora brownish yellow, with a narrow, nearly terminal black ring; claws (male) with outer tooth replaced by a low flange; wings light brown, restrictedly patterned with darker brown and yellowish subhyaline areas; macrotrichia on veins R_3 and R_{4+5} ; male hypopygium with posterior border of tergite shallowly emarginate, the actual border without setæ; outer dististyle narrowed to the apex; gonapophyses with numerous long setæ.

Male.—Length about 20 mm.; wing 22.5 mm.; antenna about 5 mm.

Frontal prolongation of head light grey above, including the elongate nasus, the sides more infuscated; palpi with basal three segments yellow, the terminal one abruptly blackened. Antennæ moderately long; scape, pedicel and basal two-thirds of first flagellar segment yellow, the remainder of organ brownish black; flagellar segments nearly cylindrical, the ends of each segment a little oblique, the apex not produced on ventral face, as in *flavicornis* and allies; verticils lacking, pubescence short and abundant. Head above rich brown, with a continuous central grey vitta over the entire length.

Pronotum infuscated above, more greyish yellow on sides. Mesonotal præscutum with the ground-colour medium brown, with four dark grey stripes, the intermediate pair narrowly bordered by darker brown; humeral and lateral regions of præscutum dark brown; scutum chiefly dark brown, the posterior portions of the lobes somewhat paler; scutellum chiefly dark brown; mediotergite light grey pruinose, extensively patterned with brown. Pleura striped longitudinally with yellow

and brown, the former occupying the dorsal portions, the latter including a narrower brownish black stripe immediately beneath the pale area, this extending from the propleura to the cephalic margin of the pteropleurite, thence much paler; still more ventrad a second paler obscure yellow stripe, the ventral sternopleurite and meral region grey. Halteres infuscated, the extreme base of stem pale, the apex of knob obscure yellow. Legs with the coxæ grey, the anterior faces more infuscated; trochanters yellow, femora obscure brownish yellow, with a narrow but conspicuous nearly terminal black ring, tibiae obscure yellow, tips narrowly darkened; tarsi obscure yellow, the outer segments blackened; claws (male) with basal tooth present, the outer one replaced by a long low flange. Wings with a light brown ground, restrictedly patterned with darker brown and yellowish subhyaline; prearcular field infuscated; stigma and small spots at origin of *Rs* and posterior end of *m-cu* darker brown; basal portion of cell Cu_1 darkened; paler areas in outer ends of cells R_5 and M_1 , near bases of cells 2nd M_2 to M_4 , near the margin on either side of vein 1st *A*, and in cell 1st *A* near vein 2nd *A*, veins brown, more yellowed in the costal field. Macrotrichia on veins R_3 and outer portion of distal section of R_{4+5} ; no stigmal trichia. Venation: *Rs* somewhat more than twice *m-cu*; *m* and petiole of cell M_1 subequal, cell R_3 constricted at mid-length, about one-half as wide as near base.

Abdominal tergites chiefly dark brown, the lateral borders light grey; sternites a little more reddish brown, the posterior lateral portions grey; hypopygium, especially the appendages, yellow. Male hypopygium with the ninth tergite transverse, its caudal border with a very shallow notch, the lobes low but broad; setæ unusually sparse, especially close to the border, there being a wide area free from these, particularly at and adjoining the mid-line. Outer dististyle broadest at near mid-length, thence tapering to the narrowly obtuse tip, provided with normal setæ, the margins not denticulate. Inner dististyle with the beak obliquely truncated at apex, lower beak even more obtuse, separated from the beak by a shallow notch; dorsal crest low and obtuse, the setæ pale, relatively short and sparse; areas of blackened pegs relatively restricted but numerous, the pegs very short.

Gonapophyses appearing as flattened plates, the surface with numerous long setæ, additional to the usual setulæ; apices glabrous, very obtuse.

Hab. Ecuador (Chimborazo).

Holotype, ♂, El Calera, near San Juan, altitude 3400 metres, April 22, 1939 (*Brown*).

From the structure of the antennæ the present fly appears to be closest to species such as *Holorusia* (*Holorusia*) *lassula* Alexander, differing conspicuously in the coloration of the body, legs and wings, and in the details of structure of the antennæ, claws and male hypopygium, particularly the ninth tergite and both dististyles.

Holorusia (*Holorusia*) *juturna*, sp. n.

Size large (wing, female, over 21 mm.); general coloration of mesonotal præscutum light grey, with four darker grey stripes that are narrowly bordered by brown; antennæ with basal segments yellow, the outer ones bicoloured, narrowly infuscated at base, the tips yellow; femora obscure yellow, the tips blackened; wings brownish yellow, restrictedly patterned with dark brown, brownish grey and yellowish subhyaline. macrotrichia on outer radial and medial veins.

Female.—Length about 18-19 mm.; wing 21-23.5 mm.; antenna about 3.8-4 mm.

Frontal prolongation of head above obscure testaceous yellow, conspicuously dark brown on sides and again paler beneath; nasus elongate, simple, slightly darkened at tip; palpi black throughout, the terminal segment relatively short. Antennæ (female) with the proximal five or six segments yellow, the succeeding segments weakly bicoloured, narrowly infuscated at base, the outer portion yellow; terminal two segments uniformly darkened; flagellar segments nearly cylindrical. Head obscure orange, heavily grey pruinose, with a narrow but conspicuous brown median stripe extending the whole length of the vertex.

Pronotum infuscated medially, more testaceous on sides. Mesonotal præscutum with the ground light grey, with four darker grey stripes that are narrowly bordered by brown, the mesal edges of the intermediate stripes forming a single conspicuous median vitta; humeral and anterolateral

portions of præscutum infuscated, the posterior portions before the suture slightly more brightened; scutum with median area buffy grey, each lobe with two darker grey areas that are ringed with brown; scutellum yellowish grey, with a delicate brown median line, parascutella chiefly pale; mediotergite yellow, sparsely pruinose, broadly infuscated on sides and with a narrow capillary brown vitta. Pleura and pleurotergite chiefly yellow, the former with a narrow longitudinal brown stripe extending from the cervical region across the propleura and anepisternum, becoming obsolete on the pteropleurite; ventral sternopleurite more greyish. Halteres with stem yellow, knob infuscated, its apex slightly brightened. Legs with the coxæ and trochanters yellow; femora obscure yellow, the tips rather narrowly but conspicuously blackened, the amount subequal on all legs; tibiæ and basitarsi brownish black to black; claws (female) simple. Wings brownish yellow, restrictedly patterned with dark brown, brownish grey and yellowish subhyaline, the darkest areas including a small spot at origin of R_s and a broad seam over the entire length of the first section of Cu_1 , chiefly in cell M , more narrowed over the distal section of Cu_1 , and $m-cu$; paler brown washes in the prearcular field, cells C' and Sc , conspicuously over the basal section of vein M_3 and as extensive areas in the outer portions of both Anal cells; stigma relatively inconspicuous, light brown; the palest areas include the bases of both Anal cells, two apical lines in cell 1st A , the smaller one adjoining vein 1st A , and with a similar line in outer end of cell Cu ; pale spots in bases of cells M_1 and 2nd M_2 ; oblitative areas small and restricted; veins brown. Macrotrichia on veins R_3 , distal section of R_{4+5} , M_1 and, in cases, M_2 . Venation: R_s elongate, slightly exceeding twice the length of $m-cu$, cell R_3 only slightly narrowed at near mid-length, the veins at this point nearly parallel; m and petiole of cell M_1 subequal or the latter shorter; $m-cu$ at fork of M_{3+4} or on M_4 immediately beyond origin.

Abdominal segments brown, vaguely more brightened at bases, the proximal tergite with indications of three stripes on a more pruinose ground; lateral borders of tergites broadly grey or yellowish grey. Ovipositor with valves long and slender. In the paratype, the abdominal tergites are more variegated, yellowish basally, brown apically,

with indications of a more or less distinct darker median vitta on the more proximal segments.

Hab. Peru (Ayacucho, Junin).

Holotype, ♀, Yanamonte, Ayacucho, in fog-forests, altitude 3000–4100 metres, August 28, 1941 (*Woytkowski*).

Paratype, ♀, Carpapata, Tarma, Junin, altitude 2600 metres, May 1, 1940 (*Woytkowski*).

Holorusia (*Holorusia*) *juturna* is most similar to species such as *H. (H.) lassula* Alexander, *H. (H.) uniatra*, sp. n., and other, differing conspicuously in the coloration of the antennæ and in the pattern of the mesonotum and wings.

Holorusia (*Holorusia*) *calypso*, sp. n.

Size large (wing, female, over 24 mm.); antennæ relatively long; mesonotal præscutum obscure yellow, with four poorly-defined brownish-grey stripes that are narrowly bordered by brown; femora brownish yellow, with a brown terminal or nearly terminal ring; wings broad, greyish yellow, restrictedly variegated with darker brown; a series of strong trichia along the posterior border of the stigma.

Female.—Length about 21 mm.; wing 24.5 mm.; antenna about 4.7 mm.

Frontal prolongation nearly as long as remainder of head, obscure yellow above, more infuscated on sides; nasus elongate; palpi brown, the third segment and apical third of terminal segment obscure brownish yellow. Antennæ much longer than in *juturna*, with about the proximal six segments pale; succeeding segments weakly bicoloured, dark basally, the narrow tips paler; outer segments uniformly brownish black; basal flagellar segment elongate, the segments thence gradually decreasing in length outwardly; proximal three or four flagellar segments with a few scattered small setæ near their basal portion. Head with front and anterior vertex orange-yellow; posterior portion of head more infuscated, sparsely pruinose; a vague capillary dark line on posterior vertex.

Pronotum obscure orange, narrowly darkened medially behind. Mesonotal præscutum obscure yellow, the humeral region more orange; disk with four rather poorly-defined brownish-grey stripes that are very narrowly and vaguely bordered by brown; scutal lobes weakly

infuscated but without distinct pattern; scutellum and postnotum brown, sparsely pruinose, the former with three more or less distinct brownish spots on base, the lateral pair depressed; mediotergite yellowish grey, with a narrow central line; pleurotergite more yellowed. Pleura and dorsopleural region yellow; a very restricted brown longitudinal stripe on the cervical sclerites and propleura, on the anepisternum much paler and more diffuse to scarcely evident. Halteres with stem brownish yellow, restrictedly clearer yellow at base, knob infuscated, paler at apex. Legs with coxæ yellow, sparsely pruinose; trochanters yellow; femora obscure brownish yellow with a brown ring at apex, somewhat deeper in colour on its proximal portion; tibiæ and tarsi obscure yellow, the tips of the individual segments very narrowly darkened. Wings broad, greyish yellow, restrictedly variegated with darker brown; prearcular field infuscated, cell *C* light yellow, cell *Sc* a trifle darker; stigma yellowish brown, its posterior border more darkened; the darker brown pattern includes a relatively small area at origin of *Rs*, seams along veins *Cu*, *m-cu* and *2nd A*, and weaker brown clouds over the anterior cord, basal section of vein *M*₃, and less evidently over the proximal ends of the outer radial veins; veins brown, more yellowish brown in the brighter portions. Sparse macrotrichia on vein *R*₃; a series of about 12 strong trichia in posterior portion of stigma. Venation: *Rs* nearly twice *m-cu*; veins *R*₃ and *R*₄₊₅ only slightly approximated at near mid-length; vein *R*₄₊₅ deflected caudad, ending close to wing tip; *m* a little longer than the petiole of cell *M*₁; *m-cu* before the fork of *M*₃₊₄.

Abdominal tergites brownish yellow, the intermediate ones somewhat clearer yellow, darkened on sides near apex; tergites six to nine more uniformly darkened; lateral tergal borders broadly grey pruinose; sternites more uniformly yellow.

Hab. Ecuador (Tungurahua).

Holotype, ♀, Rio Blanco, near Baños, altitude 1900 metres, March 1939 (*Macintyre*).

Although similar in the general pattern of the thorax to *Holorusia* (*Holorusia*) *juturna*, sp. n., the present fly is well distinguished by the elongate antennæ, distinct pattern of thorax, legs and wings, slight differences in

venational details, and in the presence of rather numerous macrotrichia in the stigma of wing.

Holorusia (Holorusia) flavogenualis, sp. n.

Size relatively large (wing, male, 22 mm.); antennæ (male) elongate; central portion of vertex pale; mesonotal præscutum with four reddish-brown stripes that are narrowly bordered by brown; thoracic pleura conspicuously striped longitudinally with light yellow and dark brown; femora with subterminal brownish-black ring, the tips and bases of the tibiæ abruptly yellow; wings medium brown, restrictedly patterned with dark brown, pale yellow and whitish subhyaline; macrotrichia on veins R_3 and R_{4+5} ; male hypopygium with the posterior border of the ninth tergite broadly notched, the vestiture of the lobes pale and normal; outer dististyle with outer half expanded into an asymmetrical head; dorsal crest of inner dististyle low and obtuse, with sparse reddish setæ.

Male.—Length about 19 mm.; wing 22 mm.; antenna about 7 mm.

Female.—Length about 22 mm.; wing 23 mm.; antenna about 4.2 mm.

Frontal prolongation of head relatively long, subequal in length to the remainder, obscure yellow, with a brown lateral line; nasus long and slender, tufted with dark setæ; palpi obscure brownish yellow, the terminal segment uniformly black. Antennæ of male much longer than that of female; about the proximal five segments yellow, the succeeding ones more darkened; flagellar segments in male somewhat obliquely truncated at ends, the extreme base a trifle produced on one side; in female, segments more nearly cylindrical, the intermediate ones vaguely bicoloured. Head in front obscure yellow, on vertex cinnamon brown, with a conspicuous pale yellow median line; a small darkened spot on anterior vertex adjoining eye.

Pronotum dark brown medially, vaguely divided by a capillary pale line; lateral portions obscure brownish yellow. Mesonotal præscutum reddish brown, with four stripes, the intermediate pair almost of the colour of the ground, narrowly bordered by darker brown; lateral stripes darker but bordered by slightly darker brown;

humeral and lateral portions of præscutum strongly infuscated; scutal lobes testaceous brown, vaguely patterned with darker, the anterior portion more yellowed; scutellum pale yellowish brown; mediotergite pale brown, sparsely pruinose, with three more or less distinct brown lines, the central one capillary; pleurotergite yellow. Pleura with a broad and conspicuous longitudinal yellow stripe on the dorsopleural region and adjoining sclerites, margined above, before the wing root, by a narrow black streak; ventrad of the yellow stripe an abrupt dark brown stripe, narrower or of nearly the same width, extending from the cervical region to the anterior border of the pteropleurite; ventral pleurites paler brown. Halteres weakly infuscated, the base of stem and apex of knob restrictedly obscure yellow. Legs with the coxæ obscure yellow, the fore and middle pairs a little more darkened; trochanters yellow; femora obscure yellow, with a narrow but conspicuous brownish-black subterminal ring, the narrower apex abruptly yellow; tibiæ brownish black, the base abruptly yellow, in amount slightly greater than the femoral tips; tarsi elongate, brown to brownish black; claws of male bidentate, of female simple. Wings relatively narrow in male, slightly broader in female; ground-colour medium brown, restrictedly patterned with darker brown and whitish subhyaline; cells *C* and *Sc* obscure yellow; stigma dark brown; small but conspicuous dark brown clouds at origin of *Rs* and posterior end of *m-cu*; a paler brown wash over basal section of *M*₃; prearcular field and base of cell 2nd *A* strongly darkened; small but conspicuous whitened obliterative areas before stigma and on basal section of *M*₁₊₂; a similar whitened streak above the stigma; small more yellowed areas near bases of cells *M*₁, 2nd *M*₂ and *M*₃, and near outer ends of cells *R*₅ and *M*₁; a conspicuous pale streak in cell *Cu* behind the vein; small pale marginal lines on either side of vein 1st *A* and in cell 1st *A* before the termination of vein 2nd *A*; veins dark brown, *Sc*, *R* and 2nd *A* more yellowed. Macrotrichia on vein *R*₃, distal half of *R*₄₊₅ and, in cases, very sparsely on *M*₁ and *M*₂. Venation: *Rs* nearly twice the short *m-cu*; *m* subequal to the petiole of cell *M*₁; *m-cu* at or close to fork of *M*₃₊₄.

Basal abdominal tergites obscure yellow, the posterior borders narrowly brown, becoming more extensive on the

outer segments; tergites five to eight with the margins, especially the lateral angles, more extensively darkened; hypopygium yellow. In female, the segments appear much darker but this apparently is due to internal discolouration. Male hypopygium with the tergite transverse, the caudal border with a broad V-shaped emargination, the lobes correspondingly widened, the vestiture of normal elongate setæ only. Outer dististyle pale, the distal half expanded into an asymmetrical head, the lower angle being more produced than the upper one. Inner dististyle with the beak rather narrowly obtuse; dorsal crest relatively low, provided with sparse reddish setæ, groups of blackened spiculæ of moderate size. Phallosome with the apophyses broadly flattened and obtuse, the surface with abundant delicate silken setulæ.

Hab. Peru (Ayacycho).

Holotype, ♂, Yanamonte, in fog-forests, altitude 3000–4100 metres, July 20, 1941 (Woytkowski). *Allotopotype*, ♀, September 1, 1941.

Holorusia (*Holorusia*) *flavogenualis* is most similar to *H. (H.) lassula* Alexander, differing conspicuously in the coloration of the legs and in all details of structure of the male hypopygium.

Holorusia (*Holorusia*) *nigrosetosa*, sp. n.

Close to *flavogenualis*; femora dark brown, the tips not or scarcely brightened; male hypopygium with the ninth tergite transverse, its posterior border with a very broad and shallow U-shaped notch that is provided with abundant black setæ that becomes more abundant and concentrated on the unusually small lateral lobes.

Male.—Length about 17 mm.; wing 19.5 mm.; antenna about 4.1 mm.

Frontal prolongation of head greyish yellow, weakly darker on sides; nasus long and slender; palpi dark brown, terminal segment black. Antennæ relatively short, greenish yellow, the outer segments a little darker; flagellar segments cylindrical, the first with several scattered setæ on proximal third. Head with front pale yellow, vertex rich reddish brown on sides, with a broad conspicuous pale median stripe.

Pronotum rich brown medially above, more testaceous yellow on sides. Mesonotal præscutum with four reddish-

brown stripes that are narrowly bordered by darker brown, the humeral and lateral portions more uniformly dark brown; posterior sclerites of notum brown, the scutellum somewhat darker; mediotergite sparsely pruinose with a capillary central dark vitta; pleurotergite pale yellow. Pleura with a conspicuous pale yellow longitudinal stripe, chiefly occupying the dorsopleural region, restrictedly more darkened above before wing root and with a conspicuous brownish-black longitudinal stripe immediately beneath; ventral pleurites paler brown; posterior sclerites of pleura clear yellow. Halteres with stem brownish yellow, the base clearer, the knob infuscated at base, its tip paler. Legs with the fore and middle coxæ brown, the posterior pair paler; trochanters obscure yellow; femora dark brown, the tips not or scarcely brightened; tibiæ and tarsi dark brown, the bases of the former restrictedly whitened; claws (male) bidentate. Wings slightly teneral, evidently with both the venation and pattern much as in *flavogenualis*.

Abdomen somewhat teneral, dark brown, the tergal incisions paler; hypopygium more yellowed. Male hypopygium with the ninth tergite quite different from that of *flavogenualis*, transverse, the posterior border with a very broad and shallow U-shaped notch, the lateral lobes correspondingly small and rounded; posterior border of tergite with abundant black setæ that become more numerous and congested on the lobes to form small tufts or brushes. Apex of outer dististyle curved strongly to one side, obtusely rounded. Inner dististyle with the dorsal crest obtuse, with unusually sparse pale elongate setæ.

Hab. Peru (Ayacucho).

1. Holotype, ♂, Yanamonte, in fog-forests, altitude 3000-4000 meters, October 5, 1941 (*Woytkowski*).

Although the present fly is closely allied to *Holorusia* (*Holorusia*) *flavogenualis*, sp. n., I feel that it is distinct since certain important structures of the male hypopygium are quite different in the two flies.

Holorusia (*Holorusia*) *monostictula*, sp. n.

Size relatively large (wing, male, over 20 mm.); mesonotal præscutum with the restricted ground buffy, with four grey stripes that are narrowly bordered by brown, the most conspicuous line of the latter being a capillary

median vitta; basal flagellar segments weakly bicoloured; femora yellow, the tips rather broadly and conspicuously brownish black; wings brownish yellow, the prearcular field and costal border darker brown, cell *Cu* and stigma paler brown; cell *M* conspicuously whitened; a small but very conspicuous brown spot at the point of union of *m-cu* and *Cu*; vein *R*₃ unusually straight; male hypopygium with the tergal lobes conspicuous, without a median denticle; inner dististyle with three separate areas of blackened spines.

Male.—Length about 19–20 mm.; wing 22–23.5 mm.; antenna about 3.4–3.5 mm.

Female.—Length about 22 mm.; wing 25 mm.

Frontal prolongation of head buffy yellow, with a sparse pruinosity; nasus stout, entire, with abundant elongate setæ; palpi brown. Antennæ relatively short and simple; basal three segments yellow, succeeding four or five weakly bicoloured, pale brown, the apex narrowly yellow, outer segments more uniformly darkened; intermediate flagellar segments with their bases slightly swollen, tapering gradually into the more narrowed tip; terminal segment elongate, about two-thirds the penultimate. Head brown, the front and anterior vertex a trifle more brightened; posterior orbits very narrowly grey pruinose; anterior vertex about three times the diameter of scape; no vertical tubercle.

Pronotum above infuscated medially, the remainder more brownish yellow. Mesonotal præscutum with the restricted ground buffy, with four grey stripes that are narrowly bordered by brown, the most conspicuous line of the latter colour being a capillary median vitta; lateral borders of intermediate stripes much more vaguely darkened, the mesal darkened edge of the lateral stripe again more evident; lateral præscutal borders more strongly infuscated; scutum obscure brownish yellow, each lobe with two confluent grey areas; scutellum obscure yellow; postnotum pale grey, the mediotergite with a pale brown linear central stripe. Pleura light grey, vaguely patterned with darker grey; dorsopleural membrane more buffy. Halteres brownish yellow to pale brown, base of stem narrowly more brightened. Legs with coxæ buffy, sparsely pruinose; trochanters obscure yellow; femora yellow, tips rather broadly and conspicuously brownish

black, the amount subequal on all legs, on the fore femora including about the distal eighth; tibiae and proximal two segments of tarsi obscure yellow, the tips more narrowly darkened; outer tarsal segments dark brown; claws (male) conspicuous toothed. Wings brownish yellow subhyaline, restrictedly patterned with darker brown and subhyaline, the darkest pattern including the prearcular field, cells *C* and *Sc*, behind encroaching slightly on cell *R*; stigma and r broad wash in cell *Cu* paler brown; a small but conspicuous dark brown spot at junction of *m-cu* and *Cu*₁; outer radial cells a trifle darker than the ground; the clearest area appears as a broad whitish streak that occupies virtually all of cell *M* and most of cell *Cu*₁; veins brownish yellow, somewhat darker in the infuscated areas. Venation: *Rs* moderately long, less than twice *m-cu*; vein *R*₂ almost straight, subequal to *m-cu*; cell 1st *M*₂ short-pentagonal, *m* longer than the petiole of cell *M*₁.

Abdominal tergites reddish brown, with a median darker brown stripe; lateral tergal borders light grey; sternites brownish yellow; subterminal segments more uniformly darkened to form a more or less distinct ring; hypopygium chiefly light yellow. Male hypopygium with the caudal border of tergite with a deep V-shaped notch, the conspicuous lateral lobes divergent, their apices and mesal borders with conspicuous strong black setæ; no median denticles. Outer dististyle obtuse at tip, about three times as long as broad. Inner dististyle with three separate areas of blackened spines; posterior crest rather strongly produced, provided with strong pale setæ.

Hab. Peru, Ecuador.

Holotype, ♂, Huanuco, Huanuco, Peru, altitude 2000 metres, September 17, 1937 (*Woytkowski*). *Paratypes*, 1 ♀, Huanta, Huanta, Peru, altitude 3900 metres, April 5, 1941 (*Woytkowski*); 1 ♂, El Calere, near San Juan, Chimborazo, Ecuador, altitude 3400 metres, April 22, 1939 (*Brown*).

The present fly is most similar to species such as *Holorusia* (*Holorusia*) *calvicornis* (Edwards), differing in all details of coloration and in the structure of the male hypopygium.

Holorusia (*Holorusia*) *zamora*, sp. n.

Size relatively small (wing, female, 16 mm.); general coloration of mesonotum brown, the præscutum without

clearly-defined stripes; pleura and pleurotergite abruptly clear light yellow; legs pale brown; wings obscure whitish subhyaline, variegated with pale brown washes and darker brown areas, including a large spot in cell *M*; cell *C* infuscated, *Sc* clear light yellow; *Rs* nearly twice as long as *m-cu*, the latter at near mid-length of vein M_{3+4} ; abdominal tergites conspicuously patterned, segments one four, five and eight chiefly yellow, two, three, six and seven dark brown; ovipositor with cerci conspicuously compressed-flattened, the hypovalvæ very small, their tips acutely pointed.

Female.—Length about 14 mm.; wing 16 mm.; antenna about 2.9 mm.

Frontal prolongation of head testaceous yellow; nasus distinct, dark brown; palpi brown, ^{1st} elongate terminal segment paling to light yellow at tip. Antennæ with scape and pedicel obscure yellow, flagellum greenish brown; flagellar segments cylindrical, the first about twice the second; succeeding segments gradually decreasing in length; segments with sparse scattered black verticils. Head above brownish grey, the front yellow; posterior orbits clear light grey; anterior vertex relatively broad, nearly four times the diameter of scape; no vertical tubercle.

Pronotum light brown medially, paler on sides. Mesonotal præscutum almost uniformly light brown, without clearly-defined stripes; pseudo-sutural foveæ small and very inconspicuous; præscutal setæ short and sparse; posterior sclerites of notum brown, the scutal lobes near suture somewhat more blackened; posterior third of mediotergite paler yellow; parascutella and pleurotergite yellow. Pleura, including dorsopleural membrane, clear pale yellow, unpatterned. Halteres with stem brownish black, the base narrowly but abruptly light yellow; knob somewhat darker with the extreme tip vaguely pale. Legs with all coxæ and trochanters pale yellow; remainder of legs pale brown. Wings with the ground-colour obscure whitish subhyaline, variegated with pale brown washes and darker brown areas; cell *C* infuscated, especially on basal portion, cell *Sc* uniformly pale yellow; stigma and a rectangular area at near mid-length of cell *M* darker brown than the remaining pattern; a restricted paler brown cloud beyond areolus; narrow brown seams at origin of *Rs*,

along cord, and as very narrow seams over the veins beyond the cord; obliterative areas at cord relatively conspicuous; veins brown. Venation: R_s about two-and-one-half times R_{2+3} or nearly twice $m-cu$; R_{1+2} unusually short and oblique, a trifle more than one-third R_3 ; distal section of R_{4+5} only moderately sinuous, cell R_3 being only slightly constricted beyond mid-length; cell 1st M_2 with outer end pointed, m oblique, about two-thirds the petiole of cell M_1 ; $m-cu$ just before mid-length of M_{3+4} .

Abdomen with first tergite abruptly light yellow, contrasting with the brown second and third tergites; tergites four and five again extensively paler, brownish yellow, with broad yellow borders; tergites six and seven dark brown, the lateral borders broadly, the posterior margins more narrowly yellow; tergite eight chiefly yellow; sternites yellow; genital shield testaceous yellow. Ovipositor with cerci conspicuously compressed-flattened, the tips narrowly obtuse; hypovalvæ very small, the tips acutely pointed.

Hab. Ecuador (Santiago-Zamora).

Holotype, ♀, Zumbi, Rio Zamora, altitude 700 metres, November 2, 1941 (*Ladley*).

Holorusia (*Holorusia*) *zamora* is most similar to small species that are allied to *H. (H.) lævis* Alexander, differing from all in the peculiar pattern of the abdominal tergites and in the details of wing pattern and venation. The structure of the ovipositor provides further distinctive characters from these species in which the female sex is known.

Holorusia (*Holorusia*) *acutistyla*, sp. n.

Allied to *strangalia*; mesonotal præscutum with four reddish-brown stripes on a brown ground; antennæ (male) of moderate length, basal flagellar segments weakly bicoloured; femora obscure brownish yellow, narrowly dark brown at tips; wings with an unusually heavy and contrasted pattern of whitish subhyaline, dark brown and paler greyish brown; cell R only slightly variegated with paler, the cells beyond cord almost uniformly darkened; male hypopygium with the outer dististyle long and slender, gradually narrowed to a short acute spinous tip.

Male.—Length about 17 mm. ; wing 18 mm. ; antenna about 5 mm.

Frontal prolongation of head brown, the long conspicuous nasus darker ; palpus with basal two segments black, the third and base of fourth brown, the apex of the latter paling to obscure yellow. Antennæ moderately long, as shown by the measurements ; scape brown, pedicel brownish yellow ; basal flagellar segments weakly bi-coloured, dark brown basally, the apex obscure brownish yellow, on the basal segments including about the outer half or less, the outer segments more uniformly dark brown ; flagellar segments subcylindrical, a trifle constricted at near mid-length, the surface with an abundant short dense pubescence ; one σ^+ , two short setæ on outer face at apex ; terminal segments a little more than one-third the length of the penultimate and much more slender. Head light yellow on front, behind the antennæ brown, stiller darker brown on the posterior vertex.

Pronotum infuscated medially, paler on sides. Mesonotal præscutum with the ground brown, with four more reddish-brown stripes, the median dark line only a little narrower than the darkenings of the interspaces ; scutum dark brown, each lobe slightly variegated with more reddish brown ; scutellum obscure reddish yellow, restrictedly more darkened at base, parascutella dark brown ; mediotergite brown, the precipitous posterior portion obscure yellow. Pleura and pleurotergite yellow, the dorsopleural membrane weakly darkened ; pleurotergite slightly pruinose. Halteres brownish black, the base of stem narrowly yellow, the apex of knob vaguely more brightened. Legs with coxæ and trochanters yellow ; femora obscure brownish yellow, the apex narrowly dark brown ; tibiæ paler brown ; tarsi brown ; claws (male) bidentate. Wings with an unusually heavy pattern of whitish subhyaline, dark brown and paler greyish brown ; whitish areas restricted to the bases of cells *Cu*, 1st *A* and 2nd *A*, an area at near one-third the length of cell *M* and an even more extensive one at two-thirds the length ; a large, more whitened prestigmal area ; in cell *R* with a linear streak near the cephalic portion, extending almost to the origin of *Rs* ; cells beyond cord almost uniformly darkened, including 1st *M*₂ ; the basal portion of cell *R*₃ with a small paler spot ; a major darker area in bases of cells *R* and *M* ;

at near mid-length of cell *M* adjoining vein *Cu*; and as conspicuous seams over *m-cu* and adjoining veins; cell *Sc* uniformly dark brown, much darker than cell *C*; stigma concolorous with the darkened cells beyond cord but narrowly ringed and delimited by incomplete darker lines; veins dark brown, paler in the obliterative portions. Venation: *Rs* long, about twice *m-cu*; cell *R*₃ strongly constricted at near mid-length; cell 1st *M*₂ relatively small, pentagonal; *m-cu* at near two-thirds *M*₃₊₄; petiole of cell *M*₁ just over one-half the length of the cell.

Abdominal tergites dark reddish brown, the posterior borders a trifle darker; lateral margins paling to obscure yellow; sternites more uniformly yellow; subterminal segments more darkened, forming a more or less distinct ring; hypopygium obscure brownish yellow. Male hypopygium with the caudal border of tergite trilobed, the lateral lobes triangular in outline, subacute at tip, their mesal margin with numerous flat blackened spines that are more or less cultrate in shape; median tergal lobe shorter, obtuse, pale, without armature. Outer dististyle long and slender, gradually narrowed outwardly, the apex a short acute spine. Inner dististyle with the beak short but relatively slender; dorsal crest conspicuous, its posterior portion almost a right angle; surface of style with unusually numerous blackened peg-like spines, arranged in three more or less distinct groups.

Hab. Ecuador (Santiago-Zamora).

Holotype, ♂, Zumbi, Rio Zamora, altitude 700 metres, November 9, 1941 (*Laddey*).

Readily distinguished from all other species of the genus with heavily patterned wings, with the exception of *Holorusia* (*Holorusia*) *strangalia* Alexander, by the structure of the male hypopygium. From the latter it differs in the coloration of the body and wings and in the details of hypopygial structure, especially the two dististyles.

Holorusia (*Holorusia*) *cristifera*, sp. n.

Allied to *sinuosa*; antennæ very short; mesonotal præscutum brownish grey, with four inconspicuous brown stripes that are bordered by slightly darker brown; wings whitish subhyaline, very heavily and conspicuously patterned with dark brown; male hypopygium with the tergite notched, with a small median lobule at base of

emargination, the lateral lobes large; inner dististyle on outer third with an elevated crest that is set with blackened points.

Male.—Length about 19 mm.; wing 20.5 mm.; antenna about 2.3 mm.

Frontal prolongation of head relatively short, less than the remainder, dark brown; nasus very long and conspicuous; basal three segments of palpi brownish black, the incisures restrictedly pale; terminal segment elongate, brownish black subbasally, the outer three-fourths paling to yellow. Antennæ unusually short; scape dark brown, restrictedly paler at tip; pedicel and flagellum obscure brownish yellow; flagellar segments subcylindrical; verticils relatively conspicuous, particularly on the outer segments and on the outer faces of the others. Front and anterior vertex yellow, posterior vertex more infuscated; a somewhat depressed area on anterior vertex, extended into a point between the antennal fossæ.

Pronotum light brown. Mesonotal præscutum brownish grey, with four inconspicuous brown stripes that are bordered by slightly darker brown; scutal lobes similarly infuscated, the central area dark grey; cephalic lateral borders of scutal lobes and adjacent margins of the suture velvety black, more extensive on sides, the scutal lobes immediately behind this slightly more brightened; scutellum light brown, with a capillary black median line; parascutella more brownish grey; mediotergite brown, strongly protuberant behind mid-length; pleurotergite dark brownish grey, the lower or cephalic half of the katepleurotergite yellow. Pleura chiefly greyish yellow, the dorsal portions of the mesepisternum and adjacent parts of the dorsopleural membrane weakly infuscated. Halteres brownish yellow, brighter at base, knob darkened, paler at apex. Legs with coxæ testaceous, sparsely pruinose; trochanters yellow; femora obscure brownish yellow, the tips narrowly brownish black, tibiæ and basitarsi light brown; remainder of legs broken. Wings whitish subhyaline, very heavily and conspicuously patterned with dark brown, about as in *sinuosa*; dark areas at base and at one-third the length of cells *R* and *M* complete, isolating the ground areas, these further broken by a brown seam along vein *M*, interconnecting the various brown areas in this field; outer radial field, excepting cell *R*₅, chiefly dark

brown with more brownish-yellow centres; outer two-thirds of cell R_5 whitened; antestigmal pale band conspicuous, extending from costa to the base of cell 1st M_2 ; centre of cell M_1 and bases of cells M_3 and M_4 restrictedly pale; outer ends of cells Cu , 1st A and 2nd A broadly paler brown, the proximal portions whitened, very extensively in cell Cu , broken by an arcular darkening in the anal field; cell C' yellow, narrowly darkened at both ends, cell Sc more brownish yellow; veins dark brown. Veins beyond cord and behind vein R_2 glabrous. Venation: vein R_3 strongly arcuated; vein R_{4+5} very sinuous, narrowing cell R_3 at near mid-length.

Basal abdominal tergites reddish brown, restrictedly patterned with darker brown, including a capillary median line and broader sublateral darkenings; distal half of tergite two and succeeding segments more uniformly dark brown, with indications of a still darker central area, posterior borders of outer segments becoming somewhat paler; lateral tergal borders broadly pale; sternites dark brown, on outer segments the posterior borders broadly yellow. Male hypopygium with the tergite extensive, the caudal margin with a broad notch, the lateral lobes triangular, conspicuous; at base of notch a small, weakly emarginate median lobe, the margins of all lobes with a border of blackened spinous setæ. Outer dististyle relatively narrow, simple, the outer third narrowed to the obtuse apex. Inner dististyle complex, the outer third more or less separated from the base by a constriction, the surface of the outer portion with a raised ridge or low crest, both the outer and central portions of style with numerous small blackened points.

Hab. Ecuador (Santiago-Zamora).

Holotype, ♂, Mayaico, Rio Nangarico, altitude 1000 metres, November 16, 1941 (*Laddey*).

The most similar species is *Holorusia* (*Holorusia*) *sinuosa* Alexander, which differs especially in the coloration and in the structure of the male hypopygium, particularly of the ninth tergite and inner dististyle.

Nephrotoma cacuminis, sp. n.

General coloration black and yellow, the former colour including three præscutal stripes, the lateral pair entirely

polished, curved laterad to the border of sclerite ; flagellar segments beyond the first uniformly blackened, moderately incised ; occipital brand broad and conspicuous ; knobs of halteres yellow ; wings with a faint yellowish tinge, cell *Sc* and the stigma brown, the latter with trichia ; abdomen reddish, in male variegated with black to form a subterminal ring ; male hypopygium with the outer dististyle strongly narrowed outwardly ; inner dististyle with the beak pale, slender ; eight sternite with its apex scarcely emarginate, the median region provided with long setæ and produced into a broad membranous lobe.

Male.—Length about 10.5–11 mm. ; wing 9.8–10.2 mm. ; antenna about 3.4–3.5 mm.

Female.—Length about 12 mm. ; wing 11 mm.

Frontal prolongation of head light yellow, narrowly darkened medially above, including the long nasus ; palpi with basal three segments testaceous yellow, terminal one blackened. Antennæ with scape yellow, pedicel weakly infuscated ; first flagellar segment yellowish brown, remainder of flagellum black ; segments rather strongly incised. Head orange, more yellowed on front and posterior orbits ; vertical tubercle conspicuous, with a very small brown spot near summit and with still another spot on either side adjoining border of eye ; occipital brand dark brown, conspicuous, more or less shield-shaped, with both ends pointed.

Pronotum medially broadly sulphur yellow, brownish black on sides and on propleura. Mesonotum light yellow, conspicuously patterned with black, the præscutum with three stripes ; lateral pair bent laterad to the border of sclerite, entirely polished ; median stripe entire, not crossing the suture behind ; lateral stripes crossing the suture onto the scutal lobes where each unites with two confluent scutal areas ; remainder of scutum yellow ; scutellum black, parascutella yellow ; mediotergite with a conspicuous 1-shaped black marking, restricting the yellow areas to the antero-lateral portions ; pleurotergite chiefly black, the callosity of the katepaleurotergite yellow. Pleura conspicuously variegated light yellow and black, the latter on the ventral sternopleurite, ventral anepisternum, on suture between the latter and the pteropleurite, and on meron ; dorsopleural membrane yellow. Halteres with stem reddish brown,

the base of knob more blackened, its apex light yellow. Legs with the fore and posterior coxæ reddish, more blackened at base or beyond, the mid-coxæ more uniformly yellow; trochanters reddened; femora yellow, the tips blackened, somewhat more gradually and extensively so on the fore legs; tibiæ obscure yellow or brownish yellow, the tips more blackened; tarsi black, only the proximal portions of basitarsi restrictedly paler; claws (male) toothed. Wings with a faint yellowish tinge, cell *Sc* and stigma brown; stigma with several trichia. Venation: *Rs* nearly oblique, only a little longer than the basal section of *R*₄₊₅; cell *M*₁ narrowly to more broadly sessile; *m-cu* a short distance before origin of *M*₄.

Abdomen reddish, variegated with black, including triangular median and lateral areas on posterior portions of the individual segments, more extensive on outer segments to form a blackened subterminal ring (in male), the restricted remainder of hypopygium reddish yellow; sternites reddened, the subterminal ring less extensive, involving segment seven and base of eight; in female, the darkenings not forming a ring. Male hypopygium with the lateral tergal lobes broadly oblique, with numerous blackened spinous points. Outer dististyle with nearly the outer half strongly narrowed to a subacute point. Inner dististyle with beak pale, relatively narrow; lower beak blackened; dorsal crest low, glabrous; extreme posterior end of style with a small stout blackened spinous point. Gonapophyses pale, appearing as gently curved clubs, the lower face with a few pale spinous points. Eight sternite transverse, narrowed posteriorly, the apex subtruncate, not evidently emarginate, provided with abundant long yellow setæ, the median region somewhat further produced into a membranous lobe that is directed more ventrad.

Hab. Ecuador (El Oro).

Holotype, ♂, Pinas, Morro Morro, altitude 1200 metres, July 21, 1941 (*Ladley*). *Allotopotype*, ♀, pinned with type. *Paratopotypes*, 1 ♂, 1 ♀.

The present fly is quite distinct from other regional species such as *Nephrotoma alleni* (Alexander) and *N. medioligula* Alexander, differing not only in the details of body coloration but especially in the structure of the male hypopygium, particularly the outer dististyle, inner dististyle, gonapophyses and eight sternite.

Limonia (Dicranomyia) contristans, sp. n.

Allied to *jorgenseni*; general coloration grey, the præscutum with three black discal stripes, in addition to the blackened lateral borders; antennæ black throughout; femora yellow with a blackened, nearly terminal ring; male hypopygium with the outer dististyle narrowed at apex into a long straight slender spine; gonapophyses with mesal-apical lobe a simple slender black spine.

Male.—Length about 6–6.5 mm.; wing 6.5–7 mm.

Female.—Length about 6.5–7 mm.; wing 7–8 mm.

Rostrum and palpi black. Antennæ black throughout; basal flagellar segments subglobular, the succeeding ones passing through obal to elongate oval, the segments with very short glabrous apical necks; terminal segment a little longer than the penultimate; longest verticils unilaterally distributed, exceeding the segments in length. Anterior vertex and a similar continuation on to the posterior vertex clear grey, the sides of the posterior vertex more blackened, sparsely pruinose; anterior vertex slightly wider than the diameter of the scape.

Pronotum blackened, sparsely pruinose; pretergites narrowly obscure yellow. Mesonotal præscutum grey, with three brown stripes, in addition to wider and more conspicuous black lateral borders, the humeral region more reddened; median stripe narrowed behind, in cases not reaching the suture; posterior sclerites of notum chiefly grey, more or less variegated with darker; posterior border of scutellum more reddened. Pleura blackened, more or less pruinose, especially a longitudinal stripe across the dorsal sternopleurite. Halteres black, the base of stem restrictedly more brightened. Legs with the fore coxæ darkened, the remaining coxæ paler, more or less pruinose; trochanters obscure yellow; femora yellow with a blackened, nearly terminal ring; tibiæ and tarsi brown, the outer segments of the latter more blackened. Wings with the ground-colour of the base and cephalic half whitened, of the apical and posterior regions more infuscated; a conspicuous darker brown pattern, especially on the cephalic half, contrasting with the whitened ground, including six major areas, the third at origin of *Rs*, continued distad along *Rs* in cell *R*; fifth area stigmal, the fourth a smaller isolated prestigmal spot;

sixth darkening in outer radial field, paler on its apical portion; other darkenings include seams over cord and outer end of cell 1st M_2 , spots in centres of cells R_5 to M_4 , inclusive, and a darkening at end of vein 2nd A ; veins brown, paler in the costal field. Venation: Sc_2 ending opposite the origin of Rs , Sc_2 at its tip; Rs angulated and short-spurred at origin; $m-cu$ some distance before the fork of M , in extreme cases equal to its own length.

Abdomen, including hypopygium, black; posterior borders of sternites very narrowly pale. Male hypopygium with the caudal margin of tergite rather weakly notched. Basistyle with the ventromesal lobe stout, simple. Dorsal dististyle stout, abruptly narrowed into a long straight slender spine. Ventral dististyle a small fleshy lobe, the pale portion smaller in area than the more darkened rostral prolongation; spines separated, the outer one a little shorter than the more basal one. Gonapophysis with mesal-apical lobe a simple slender black spine, the outer margin of the apophysis before the spine microscopically serrulate.

Hab. Peru (Huanuco, Ayacucho).

Holotype, ♂, Huanta, Huanta, Ayacucho, altitude 3800 metres, April 14, 1941 (*Woytkowski*). *Allotopotype*, ♀, altitude 3900 metres, April 1, 1941. *Paratopotypes*, several ♂♀, April 1-17, 1941; *paratypes*, 1 ♂, Ayna, La Mar, Ayacucho, altitude 2400 metres, April 30, 1941 (*Woytkowski*); 1 ♂, Huanuco, Huanuco, altitude 3000 metres, April 1, 1941 (*Woytkowski*).

The only nearly related species so far made known is *Limonia* (*Dicranomyia*) *jorgenseni* (Alexander) of Catamarca, Argentina, which differs in the structure of the male hypopygium, particularly of the dorsal dististyle and gonapophysis, and in slight details of coloration and venation.

Limonia (*Rhipidia*) *banosensis*, sp. n.

General coloration light grey pruinose, the præscutum variegated with more reddish-brown stripes; antennæ (male) unusually simple, the flagellar segments only a little produced; wings whitish subhyaline, restrictedly patterned with brown; no dark spot at near mid-length of cell Sc ; abdomen dark brown, the centres of the outer tergites paler; male hypopygium with the tergal lobes closely approximated, separated only by a small median notch, provided with a concentration of conspicuous black

setæ; basistyle with a small lobule at base of ventromesal lobe; rostral spines three, arising close together at near mid-length of the prolongation, the latter subacute at tip.

Male.—Length about 6.5 mm.; wing 7.5 mm.

Rostrum brownish grey; palpi black. Antennæ with scape and pedicel black; only five flagellar segments remain, these unusually simple and but slightly produced, the distal end abruptly narrowed into a glabrous stem, the lower face very slightly bulging; flagellar segments dark brown, paler at base and, especially, the whitened apical stems. Head dark brown, presumably pruinose in fresh specimens.

Pronotum chiefly dark brown. Mesonotal præscutum light grey pruinose, with three more reddish-brown stripes, the lateral pair very poorly indicated; humeral region and lateral ends of suture more yellowed; scutal lobes dark brown, the median area more pruinose; scutellum infuscated basally, the apex obscure yellow; mediotergite grey, pleurotergite paler, except on ventral portion. Pleura grey, striped longitudinally with dark brown. Halteres obscure yellow, the base of stem narrowly yellow, knob infuscated. Legs with coxæ infuscated, especially the fore and middle pairs; trochanters yellow; remainder of legs broken. Wings whitish subhyaline, with a restricted pale brown pattern that is suggestive of *domestica*, including small spots at arculus, origin of *Rs* and fork of *Sc*; stigma pale, encircled by slightly darker brown; very narrow and vague seams over cord, outer end of cell 1st M_2 and as a seam in cell *M* adjoining vein *Cu*; prearcular and costal fields somewhat more yellowed, including the veins, the remaining veins brown; no darkened washes in centres of cells and no darkening at mid-length of cell *Sc*, basad of origin of *Rs*, as in *domestica*. Venation: *Sc* relatively long, Sc_1 ending just beyond mid-length of *Rs*, Sc_2 near its tip; *Rs* straight, approximately twice as long as R_{2+3} ; free tip of Sc_2 and R_2 in transverse alignment; cell 1st M_2 subequal in length to vein M_4 ; *m-cu* at or immediately beyond the fork of *M*.

Basal abdominal tergites dark brown, the sternites somewhat paler; outer segments with the centres of the disks much paler; hypopygium chiefly yellow. Male hypopygium with the tergite semicircular in outline, the

entire posterior border strongly rounded, with a very small median notch, the lobes thus closely approximated, provided with long conspicuous blackened setæ. Basistyle with the ventromesal lobe blackened, relatively short, the apex subtruncate; on posterior margin at base with a much smaller lobule that is tipped with several long setæ. Dorsal dististyle relatively long and slender, the outer third curved, the tip acute, the outer end of style extending to beyond the margin of the ventral dististyle. Ventral dististyle relatively small, its total area about one-fourth greater than that of the basistyle; rostral prolongation strong; spines three, shorter than the prolongation, arising close together at or just beyond mid-length of the prolongation, the latter subacute at tip. Gonapophysis with mesal-apical lobe blackened, erect.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Baños, altitude 1900 metres, July, 1936 (*Macintyre*).

Although it superficially resembles *Limonia* (*Rhipidia*) *domestica* (Osten Sacken) and other allied forms, the present fly is quite distinct, differing particularly in the structure of the antennæ, details of wing pattern and venation, and in the structure of the male hypopygium, especially the tergite, dorsal dististyle and ventral dististyle.

Atarba (*Ischnothrix*) *capitella*, sp. n.

General coloration of thoracic notum pale brown, the central area of præscutum obscure yellow; antennæ (male) elongate, slightly exceeding the wing in length, the flagellar segments with long outspreading verticils; legs dark brown to brownish black; wings with a strong brownish tinge, the prearcular and costal fields more yellowed; stigma small, darker brown; *Sc* short, vein *R*₂ short and erect, *m-cu* at near mid-length of the small cell 1st *M*₂; male hypopygium with the spines of the ninth sternite long and slender, decurved; eighth sternite with its caudal border produced into an entire transverse lobe, the caudal border of which is subtruncate to weakly convex, provided with microscopic setulæ.

Male.—Length about 5.5 mm.; wing 5 mm.; antenna about 5.5 mm.

Rostrum yellow; palpi brownish black. Antennæ (male) slightly longer than the wing; scape and pedicel obscure yellow, flagellum black; flagellar segments very elongate-cylindrical, with long outspreading verticils scattered over the entire length of the segments, with interpolated shorter setæ of less than half this length; the longest verticils are shorter than in *seticornis* but much longer than in *geminata*; punctures of the major setæ sparser and less crowded than in *geminata*. Head obscure brownish yellow.

Pronotum brownish yellow. Mesonotal præscutum with the central portion obscure yellow, the sides a trifle more darkened; posterior sclerites of notum apparently darker, but this region of body not clearly visible in the type. Pleura obscure yellow. Halteres infuscated, base of stem yellow. Legs with the coxæ brownish yellow; trochanters yellow; remainder of legs dark brown to brownish black, the femoral bases restrictedly more brightened; tibial spurs very short, less than the surrounding setæ, apparently a trifle longer than in *geminata*. Wings with a strong brownish tinge, the prearcular and costal fields more yellowed; stigma small, darker brown than the ground; veins dark brown somewhat paler brown in the brightened costal field. Venation: *Sc* short, *Sc*₁ ending just beyond the origin of *Rs*, *Sc*₂ exactly opposite this origin; *Rs* relatively long, strongly angulated beyond origin; vein *R*₃ short and erect, a little exceeding the distance on margin between the tips of veins *R*₁₊₂ and *R*₃; vein *R*₄ subequal to *R*₂₊₃₊₄; cell 1st *M*₂ rectangular, relatively small, shorter than any of the veins beyond it, with *m-cu* at near mid-length.

Abdomen weakly bicoloured, brown, the incisures, particularly the bases, somewhat paler; hypopygium brownish yellow, the outer dististyle blackened. Male hypopygium with the outer dististyle a gently arcuated rod, the apical point scarcely larger than the subapical spines; outer margin of style with abundant appressed teeth, those near the base much smaller. Inner dististyle strongly narrowed outwardly, the tip narrowly obtuse. Spines of ninth sternite long and slender, strongly divergent and decurved, closely approximated at bases, thence narrowed to the acute tips. Appendage of eighth sternite a transverse suboval lobe, appearing more or less

capitate, its outer margin subtruncate to weakly convex, provided with microscopic setulæ.

Hab. Peru (Junin).

Holotype, ♂, Satipo, Jauja, altitude 800–900 metres, May 29, 1940 (*Paprzycki*).

Although the shape of the lobe of the eighth sternite is quite different, the present fly is evidently more closely related to *Atarba* (*Ischnothrix*) *geminata* Alexander than it is to certain other species that have this lobe entire, these including *A. (I.) integriloba* Alexander. Comparisons with *geminata* have been given in the above description.

Atarba (*Ischnothrix*) *digitifera*, sp. n.

Allied to *geminata*; antennæ of male long, exceeding the wing; longest setæ conspicuous; mesonotum more or less pruinose, the præscutum with three brown stripes, the median one especially distinct; wings very pale brown, stigma oval, medium brown; *Rs* angulated beyond origin; male hypopygium with the outer dististyle having large and relatively few spinous points along the outer face; appendage of eighth sternite pale, produced into two slender finger-like lobes.

Male.—Length about 6 mm.; wing 6.5 mm.; antenna about 7 mm.

Rostrum light brown, sparsely pruinose; palpi brownish black. Antennæ (male) elongate, exceeding the wing; scape and pedicel brownish yellow, flagellum black; segments very elongate-cylindrical; verticils abundant, distributed over the entire segment, the longest more or less unilaterally angled; longest setæ nearly four times the diameter of segment, opposite the point of insertion, in *geminata* approximately three times this length. Head above grey, the occipital region a little more brightened.

Pronotum reduced, brown, sparsely pruinose. Mesonotal præscutum obscure yellow on sides, darker medially, the surface more or less pruinose, with three brown stripes, the central one especially distinct; scutellum testaceous yellow; mediotergite light grey pruinose. Pleura and pleurotergite testaceous yellow, sparsely pruinose. Halteres broken. Legs with the coxæ and trochanters yellow; remainder of legs pale brownish yellow, the terminal tarsal segments a little darker; tibial spurs a little more than one-half as long as the surrounding setæ.

Wings very pale brown, the prearcular and costal portions a little more yellowed; stigma small, oval, medium brown; veins brown, more brownish yellow in the brightened portions. Venation: Sc_1 ending shortly beyond the origin of Rs , Sc_2 a short distance beyond this origin; Rs longer than in *geminata*, angulated beyond origin; $m-cu$ about one-half to two-thirds its length beyond the fork of M .

Abdomen pale brown, with a darker subterminal ring; hypopygium yellow, the outer dististyles blackened. Male hypopygium with the spines of the outer dististyle larger and fewer than in *geminata*. Appendage of ninth sternite almost as in *geminata*. Appendage of the eighth sternite entirely pale, the colour including the base of the plate and adjoining apical portions of the sternite; lobes of the appendage longer and more slender than in *geminata*, separated by a conspicuous U-shaped notch.

Hab. Peru (Junin).

Holotype, ♂, Huacapistana, Tarma, altitude 3600–5400 feet, February 20, 1940 (*Woytkowski*).

The most similar species is *Atarba (Ischnothrix) geminata* Alexander, which differs in the coloration, the shorter antennæ of the male, and in the details of structure of the male hypopygium, especially the outer dististyle and appendage of the eighth sternite.

Atarba (Atarba) tungurahuenensis, sp. n.

Allied to *bulbifera*; antennæ (male) elongate, black, the incisures of the more proximal flagellar segments narrowly brightened; pubescence of flagellar segments subtended by small points to produce a scabrous appearance; femora yellow, the tips narrowly infuscated; wings weakly patterned with brown; male hypopygium with the appendage of the ninth sternite gently concave at apex, the horns slender; outer dististyle with the spines relatively few but large, restricted to the expanded outer third of style; inner dististyle blackened; gonapophyses without spines; aedeagus relatively long, without lobes or protuberances.

Male.—Length about 6 mm.; wing 6.8 mm.; antenna about 5 mm.

Female.—Length about 6 mm.; wing 6.5 mm.

Rostrum obscure brownish yellow; palpi brownish black. Antennæ (male) elongate; scape and pedicel obscure yellow; flagellar segments long-cylindrical, black, the more proximal ones with the incisures very restrictedly yellow, including both the bases and apices of the segments; verticils unilaterally distributed, slightly exceeding one-half the length of the segments; entire surface with a short erect pubescence, the hairs subtended by small points to produce a scabrous appearance. Head testaceous yellow; anterior vertex relatively narrow, only a little wider than the diameter of scape.

Thorax reddish yellow, the surface sparsely pruinose, somewhat more heavily so on the postnotum and pleura. Halteres with stem yellow, knob weakly darkened. Legs with the coxæ and trochanters testaceous yellow; remainder of legs yellow, the tips of femora very narrowly infuscated; terminal tarsal segments blackened; tibial spurs distinct. Wings greyish yellow, the prearcular and costal fields, together with a line along vein *Cu* clear light yellow; stigma oval, medium brown and relatively distinct; a narrow brown seam along cord and less evidently over the outer end of cell 1st M_2 ; veins brown, yellow in the brightened areas. Venation: *Sc* short, Sc_1 ending opposite or immediately before origin of *Rs*, Sc_2 a short distance from its tip, Sc_1 alone subequal to or a little exceeding $r-m$; *Rs* short, about twice the basal section of R_5 ; branches of *Rs* generally parallel to one another, the anterior one very gently sinuous; cell 1st M_3 shorter than vein M_4 ; $m-cu$ about one-third to one-half its own length beyond the fork of *M*.

Abdominal tergites obscure brownish yellow, the lateral margins more blackened; subterminal segments black, to form a broad ring; hypopygium yellow. Male hypopygium with the appendage of the ninth sternite produced laterad into a slender spine, the apex gently concave. Outer dististyle clavate, more expanded on outer half, at apex, further produced into a slender portion that divides at apex into two subapical teeth; the expanded portion of style with several appressed teeth, the basal two-thirds of style unarmed. Inner dististyle longer, slender, dark-coloured throughout. Gonapophyses appearing as pale flattened blades, each more or less trough-shaped but without spines. *Ædeagus* relatively long, only slightly

expanded at apex and without other lobes or protuberances.

Hab. Ecuador (Tungurahua).

Holotype, ♂, Above Baños, altitude 2500 metres, May 6, 1939 (*Mucintyre*). *Allotopotype*, ♀, pinned with type *Paratopotype*, 1 ♀, pinned with type.

Atarba (*Atarba*) *tungurahensis* is closest to *A. (A.) bulbifera* Alexander, which has the vestiture of the antennæ somewhat the same and with the wings likewise weakly patterned. The two species differ conspicuously in several details of structure of the male hypopygium, particularly the appendage of the ninth sternite, the inner dististyle, and the ædeagus.

Teucholabis (*Teucholabis*) *azuayensis*, sp. n.

Allied to *brevisetosa*; general coloration polished black, the thorax restrictedly variegated with paler; basal flagellar segments more or less enlarged, subglobular, with short pale apical stems; posterior basitarsi conspicuously dilated on about the proximal half; wings whitish subhyaline, virtually unpatterned except for the stigma; abdomen polished black, the posterior borders of the segments, especially the outer sternites, yellow; male hypopygium with the outer dististyle bearing a large lateral branch, the entire style conspicuously setiferous; apex of ædeagus produced into a large flap that bears several long coarse setæ.

Male.—Length about 4.7–5 mm.; wing 5.5–5.8 mm.

Rostrum and palpi black. Antennæ black; basal flagellar segments enlarged, subglobular, separated from one another by very short abrupt pale pedicels, these placed on one side of the central axis so the segments are asymmetrical; on the seventh or eighth flagellar segments the stems are lost and the segments pass into oval. Head polished black.

Thoracic notum polished black, the sides of the scutellum, pretergites and restricted humeral region of the præscutum obscure yellow; very vague brightenings along the suture; posterior border of scutellum testaceous yellow. Pleura and pleurotergite black, on the dorsal sternopleurite and again on the metapleura with paler areas that are covered with a silvery pubescence, producing a short, sometimes broken stripe. Halteres brownish

black, the apex of knob light yellow. Legs with the coxæ brownish black, the tips paling to obscure yellow; trochanters dark brown; femora obscure brownish yellow basally, the outer portion blackened and somewhat dilated, the amount of black somewhat greater on the fore legs; tibiæ dark brown, the tips more blackened; tarsi black; posterior basitarsi conspicuously dilated on about the proximal half. Wings whitish subhyaline, the small stigma conspicuous, dark brown; basal portion of cell *Sc* infuscated; veins dark brown, those in the prearcular field more yellowed. Venation: *Sc*₁ ending nearly opposite one-third the length of the arcuated *R*_s; branches of the latter parallel to one another except near their tips, *R*₅ thence deflected to the wing tip; cell 1st *M*₂ almost twice *M*₄.

Abdomen polished black, the posterior borders of the segments very narrowly pale yellow, on the outer sternites becoming much broader and more conspicuous; hypopygium black. Sternal pocket restricted to the fifth segment, transverse. Male hypopygium with the lobe of basistyle a strong flattened rod, at its apex deflected into a long straight spine. Outer dististyle conspicuous, the principal blade acute at tip, on mesal edge bearing a large lateral branch that is produced directly into a strong spine, the surface of style with abundant conspicuous setæ, shorter but more abundant on the lateral branch and axil. Inner dististyle with the main stem an erect flattened blade, the apex obtuse, on margin before tip produced into a short blunt point; lobe at base of style extensive, more or less scoop-shaped, the margin with about five strong setæ. Apex of ædeagus produced into a large flap that is provided with several long coarse setæ.

Hab. Ecuador (Azuay).

Holotype, ♂, Cuenca, altitude 2500 metres, February 19, 1939 (*F. M. Brown*). *Paratopotypes*, 3 ♂♂.

The nearest described ally of this fly is *Teucholabis* (*Teucholabis*) *brevisetosa* Alexander, of Peru, which differs in slight details of coloration and in the structure of the male hypopygium, especially the outer dististyle and ædeagus.

LXXIV.—*A new Scotonycteris, with Notes on other Gold Coast Bats.* By R. W. HAYMAN Department of Zoology, British Museum (Natural History).

AMONG the small mammals recently collected in the Gold Coast of West Africa by Mr. G. S. Cansdale for the British Museum are some interesting bats, one of them new, which add considerably to our knowledge of the Chiroptera of that region and demonstrate that we have much yet to learn about the smaller mammals of the West African forest regions.

The new form is a small fruit bat, belonging to a genus of some rarity in collections, and may be known as

Scotonycteris ophiodon cansdalei, subsp. n.

Type.—♀ skin and skull, B.M. No. 46.229, collectors' number 420. Collected at Oda, Oda District, Central Province, Gold Coast, December 24, 1945, by G. S. Cansdale. A very young specimen, No. 46.230, preserved in alcohol, was taken clinging to the type., "Suspended in tree in forest; solitary." (Note by collector.)

Diagnosis.—Closely similar to *Scotonycteris ophiodon* Pohle (1943) in size and most external, cranial and dental characters, but differing externally in having a conspicuous white patch at the posterior angle of each eye, an inconspicuous white spot at the anterior base of the ears (both spots lacking in *ophiodon*), and in the white border of the upper lips only reaching two-thirds of the way forward towards the nostrils (in *ophiodon* the white lip border is said to include the nostrils); and cranially in the long and thin postorbital processes (short and thick in the unique type of *ophiodon*), in the horizontal basicranial axis (deflected in *ophiodon*), and in having a distinct, though low, sagittal crest; the latter may well be an age character. (For measurements see Table I.)

Colour.—As the type of *Scotonycteris ophiodon* had been in spirit for forty-four years when Pohle described it, he was not in a position to give much account of its colour, beyond stating that it appeared to have the same general pattern as in *S. zenkeri* Matschie (1894), but somewhat lighter and yellower, a difference which might well be due, in my opinion, to the bleaching effect of long immersion in alcohol. The following general account of the colour

of the Gold Coast form, *cansdalei*, based partly on Cansdale's notes from the fresh specimen, partly on the dry skin, shows that it has a striking similarity to *zenkeri* and also to *Casinycteris argyannis* Thomas (1910).

The dorsal hair above has three colour zones, dark brown basally, dirty white medially, fawn distally, the general effect varying according to the length of hair and length of the whitish zone. On the neck and shoulders the hairs are longer than on the hinder portion of the back and have a much wider whitish zone, which shows through the fawn tips. Further back the whitish zone is very narrow and the hair is shorter, so that the general effect is much darker, and on the rump the pale zone is absent and the hairs are almost uniformly brown. Below, the hair on throat and lower neck is very sparse, is almost white, and the pale flesh skin is exposed. From the lower neck a pale abdominal patch, a dirty whitish heavily washed with dull buff, continues for some way, and is set off by the contrasting dark brown of the sides of the belly, the flanks and the anal region. On the head the white patch on muzzle, the white border of the lips (not reaching the nostrils), and the white patch behind the eyes, are conspicuous, but the white spot at the anterior base of the ears mentioned by Cansdale *in litt.* is so small and indistinct that in the dry skin it could easily be overlooked, and it seems likely that the type of *ophiodon*, after forty-four years in alcohol, would probably be too bleached to show such an inconspicuous feature. According to the collector, the wing membranes are yellowish-brown, and the bare skin of mouth, eyelids and ears dark yellow (in the dry skin the three latter are dark brown). The wing membranes are prominently reticulated, and the joints of phalanges and metacarpals are pale yellow, much as in *Casinycteris*.

Remarks.—In 1943 Pohle described *S. ophiodon* from Bipindi, Cameroons, as the second species of the genus, previously known only by the genotype, *S. zenkeri*, whose range included the Cameroons and Fernando Po. *S. ophiodon* was characterised by its much 'greater size (forearm 75, in *zenkeri* 48–54), and by striking dental peculiarities, of which the most important are the secondary cusps on the inner edges of upper and lower canines, and the heightening of the canines and cheek-

Table I.—Measurements of *Scotonycteris ophiodon* and *S. o. canadensis*.

	Head and body.	Tail.	Hindfoot.	Ear.	Forearm.	Pollex.	2nd metacarpal.	3rd metacarpal.	4th metacarpal.	5th metacarpal.	Skull, total length.	Palation to inc. foramina.	Palation to basion.	Post-dental palate.	Rostrum.	Braincase at zygomatic root.	Zygomatic breadth.
<i>S. ophiodon</i> , type...	105	1	14	20.5	75	36.5	39	54	50	51	36	17.6	12.2	6.4	9.2	16	21
<i>S. o. canadensis</i> , type	115	—	15	22	76	31	35	52	49	50	36	17	13	6	10	15	22.5
	Breadth, $m^1 m^1$.	Breadth, o-c.	Breadth of post-orbital processes.	Interorbital constriction.	Diameter of orbit.	Length of mandible.	Height at coronoid.	Upper tooth row $c-m^2$.	Height c^1 .	Height p^2 .	Height p^1 .	Height m^1 .	Height c^1 .	Height p^2 .	Height p^1 .	Height m^1 .	Height m^2 .
<i>S. ophiodon</i> , type ..	12.6	6.7	11.2	6.4	9	*26.5	11.2	11.9	6.1	3.8	3.1	2.3	4.1	4.1	3	2.4	1.1
<i>S. o. canadensis</i> , type.	12	7.5	14	7	9	26.5	12	12	5.5	4	3	2	4	4	3	2.1	1.2

* Length of mandible was given by Pohle as 16.5, but this is obviously an error; in view of the identical total lengths of the skulls it is assumed that 26.5 was the figure intended.

teeth, the latter being provided with prominent inner cusps. *S. ophiodon* also lacks the white spot behind the eye found in *zenkeri*, although agreeing with the latter in most other respects in facial pattern and body colour.

Pohle considered that some of the characters of *ophiodon*, particularly those of the cheek teeth, showed affinity to *Casinonycteris argynnis*, whose close external similarity to *Scotonycteris* has been commented on by Andersen (1912): in fact Pohle expressed the view that the extraordinary shortening of the palate in *Casinonycteris*, the chief diagnostic feature of the genus, is merely an abnormality, akin to the "cleft palate" sometimes found in mammals, and as such to be discounted. Moreover, he also took the view that even if it were not an abnormality in itself, such a feature, being found nowhere else in the Megachiroptera, should not on the evidence of one skull be regarded as a character of sufficient stability to justify the founding of a genus. On these grounds he proposed to relegate *Casinonycteris* to the synonymy of *Scotonycteris*, while retaining the species *argynnis*. Unfortunately for this theory, however, it must be pointed out that Pohle's declaration that only the type skull is known of *argynnis* indicates that he overlooked the fact that at the time at least two other skulls of this rare bat had been reported on. One was recorded by J. A. Allen (1917) from the Eastern Congo (with comments on its peculiar skull and palate by Lang and Chapin (1917a); another was recorded from the Uele District of the Eastern Congo by Schwarz (1920), who gave measurements showing a similar extreme shortening of the palate as in the type. In view of these facts it seems clear that Pohle's dismissal of the chief generic character of *Casinonycteris* as an abnormality must be disregarded, and that the genus must stand.

Although the heightening of the inner cusps of the cheek teeth in *ophiodon* and *cansdalei* is a feature more nearly approaching the dentition of *Casinonycteris argynnis* rather than *Scotonycteris zenkeri*, the normal palate makes inclusion in the former genus out of the question; the prominent secondary cusps on all canines form the most marked feature in which both *ophiodon* and *cansdalei* differ from both *S. zenkeri* and *Casinonycteris*, but I am not prepared to add a generic or subgeneric name to the

literature on that account. I have used a subspecific name for this Gold Coast *Scotonycteris* chiefly for convenience in expressing its relationship to *ophiodon*, but am quite prepared to find eventually that *canadalei* will be raised to specific rank; the cranial differences, particularly the absence of a basicranial deflection, combined with the external difference in the head markings, may later be regarded as of specific value.

The discovery in the Gold Coast of this most interesting fruit bat by Mr. Cansdale, whose name I am glad to link with it, shows that special search for Chiroptera in the forest zones of Africa is likely to produce yet more surprises, both in new forms and in furthering our knowledge of the distribution of species already known elsewhere.

The following notes on certain other bats collected in the same area by Mr. Cansdale may be of interest.

Glauconycteris poensis (Gray). ♂ and ♀, B.M. Nos. 46.237, 46.238. Collectors' numbers 376, 342; in alcohol. Oda.

Both have a pale shoulder spot; the ♂ has a definite flank stripe in addition, the ♀ is without. Thus these two represent the colour patterns found in *G. alboguttatus* J. A. Allen (1917 b) and *G. humeralis* of the same author (1917 c) respectively, both from the Eastern Congo. As I have pointed out elsewhere (1939), spots and stripes are developed to a greater or lesser extent in certain other species of the genus, and in view of the wide difference in these two Gold Coast specimens, otherwise alike, one may reasonably question whether these light markings are in themselves sufficiently reliable characters to be used for specific differentiation. Size and other differences, however, indicate that *alboguttatus* and *humeralis* may be distinct forms.

In these Gold Coast specimens the general colour is pale buffy grey, the dorsal hairs with dark bases, dirty white medially, pale buff terminally; below whiter, particularly on the chin. The forearm measurement is 38 and 40 mm.

It seems probable that the Nigerian specimen, referred to *alboguttatus* by Sanborn (1936), is actually a *poensis*. The colour given agrees well with the latter but not at

all with the "seal brown" (without qualification) given by Allen for *alboguttatus*, and in view of the irregularity of the flank band demonstrated by these two Gold Coast examples, it seems well not to rely too much on this feature.

Myopterus whitleyi (Scharff). ♂ immature, B.M. No. 46.239; ♀ adult B.M. No. 46.240. Collectors' numbers 356, 298; in alcohol. Oda.

This appears to be the first record of the genus in the Gold Coast, the only specimens of this species previously recorded having been taken in Nigeria. The larger *M. senegalensis* Oken is known only from Senegal, and *M. albatrus* Thomas from the Belgian Congo. Cansdale's two specimens agree well in all respects with the type in the British Museum. When dried out, the colour in the adult ♀ is very pale brown above, dirty white below. The immature ♂ is dark sooty brown above, similar to the ♀ below. All membranes are yellowish white, and the translucence of the ears is a noticeable feature.

Measurements of adult ♀.—Head and body 56, tail 30, hind foot 7, ear 16, forearm 36. Skull: greatest length 18, condylobasal length 17, zygomatic breadth 11, upper tooth row $c-m^3$ 7, breadth across m^3-m^3 8.

Both skulls are low, smooth and without sagittal crest. In this connection it is difficult to understand Thomas's reference, in describing *M. albatrus* (1915) to "the high and abrupt sagittal crest so well marked in *Eomops* (now *Myopterus*) *whitleyi*," since one of the cranial characters of *Myopterus* is its smooth and rounded brain-case, not crested, as defined by Thomas himself (1905) on examination of the type-specimen of *whitleyi*.

?*Mops calabarensis* Hayman (1940). ♀ adult, B.M. No. 46.242; ♂ immature, B.M. No. 46.241. Collectors' numbers 382, 344; in alcohol. Oda.

In all external characters these two specimens agree well with *calabarensis*, hitherto known only by the type from Calabar, South Nigeria, but the first lower premolar is definitely smaller than the second, whereas in the type the reverse is the case. The essential resemblances in other respects, size, form and colour, are so close that I have referred them to this species at least provisionally.

The only other *Mops* of approximately equal size, *M. nanulus* J. A. Allen (1917 d), is of quite different colour. Further specimens may show whether there is any systematic importance in the comparative size of the premolars.

Measurements of adult ♀.—Head and body 54, tail 22, ear 14, forearm 30 (corresponding figures for immature ♂ 50, 24, 14, 29). Skull of adult ♀: greatest length 17, zygomatic breadth 10, upper tooth row $c-m^3$ 6.

Hipposideros abæ J. A. Allen. ♂♂, B.M. Nos. 46.107, 46.331; ♀ 46.233; in alcohol. ♀♀, B.M. Nos. 46.108, 46.109, skins with skulls. All from Anamabu, Cape Coast, Gold Coast.

I have provisionally adopted Allen's name for these specimens, originally determined as *H. fuliginosus* (Temminck) (1853), on account of the presence of a very well-marked frontal sac in the males (represented in females by a slight depression containing a tuft of bristle hairs). According to Andersen's diagnosis (1906) of *fuliginosus* the frontal sac is completely absent in that species.

The whole question of the taxonomic value of a secondary sexual character, such as the frontal sac in some species of *Hipposideros*, is raised by this case, for the following reasons. Cansdale's specimens, apart from the presence of the distinct frontal sac in males, agree well enough in dimensions, external and cranial characters with the specimen "b" of Dobson's Catalogue, regarded by Andersen as an authentic *fuliginosus*. The forearm, for example, varies from 59–61 mm. in the Gold Coast specimens, and is 61 in Andersen's *fuliginosus*. J. A. Allen's *H. abæ* (1917 e), from the N.E. Congo, is a bat of apparently the same type as Cansdale's specimens, with a forearm varying from 58.5 to 60.5, and like them has a frontal sac in the males.

In the British Museum collection are two male *Hipposideros* from the Ituri Forest, E. Congo (Howard de Walden Collection, B.M. Nos. 30.11.11.143–144), which agree with *fuliginosus* in entirely lacking the frontal sac. They are a little larger, however, with forearms of 63 and 64. It appears that a group of large *Hipposideros* exists in the forest region from the Gold Coast to the Eastern Belgian Congo, having a forearm measurement of from 58.5 to 64, and indistinguishable among themselves in essentials

with the sole exception of the presence or absence of a frontal sac in the males. The question whether these two divisions should be accorded specific rank, or whether such a secondary sexual character is subject to seasonal or individual modification to the point of complete loss, remains to be answered. In view of the fact that certain other secondary sexual characters in some other tropical bats are known to be subject to seasonal or individual development or retrogression, *e. g.*, the crest or tuft in *Chærophon* (made the basis of the subgenus *Lophomops* by J. A. Allen (1917 f), but since shown by Braestrup (1933) to be of a seasonal character), and the axillar tuft in *Rhinolophus lobatus* Peters (shown by Hayman (1940 a) to be an individual male character), it was thought possible that the frontal sac in the males of so many species of *Hipposideros* might also be subject to seasonal or individual development, although its greater structural complexity suggested a more permanent character.

All Allen's *abæ* were collected in December; the two Ituri males lacking the frontal sac in May; Cansdale's specimens in December. There is, however, no record of the date of collection of the Calabar specimen taken by Anderson to represent the true *fuliginosus*.

An examination of other species of *Hipposideros* possessing a frontal sac in the males has revealed that in general, working on smallish series, it appears to be a constant feature, quite well developed in immature males, and that its variation in form and position in different species, and its complete absence in others, indicates a certain taxonomic value. But the examination of a much larger number of males of one species, namely sixty-nine *H. caffer* in alcohol, shows that although in sixty-four cases the sac is fully developed, in five specimens (one from Cameroons, one from Elgon, and three from Senegal) it is totally absent. In these five, however, areas of naked skin mark the normal position of the gland, whereas in the two *fuliginosus* from the Ituri the whole area is fully haired. Unfortunately the specimen quoted by Andersen as typically *fuliginosus* has not at present been traced.

The form of the frontal sac in the Gold Coast specimens referred to *abæ* is notably distinct from that found in *H. caffer*. It is deeper, wider, and has prominent naked

Table II.—Measurements of *Hipposideros fuliginosus* and *H. abae*.

	<i>H. fuliginosus.</i> (No frontal sac.)			<i>H. abae.</i> (With frontal sac.)					
	♂, Calabar (after Andersen).	♂, Turin. 30.11.11.143.	♂, Turin. 30.11.11.144.	N.E. Congo, type (after J. A. Allen).	♂, Gold Coast. 46.107.	♂, Gold Coast. 46.232.	♀, Gold Coast. 46.233.	♀, Gold Coast. 46.108.	♀, Gold Coast. 46.109.
Head and body									
Tail	34	63	62	66	66	61	60	65	68
Hindfoot	—	32	32	38	35	34	30	37	38
Tibia	—	11	11.5	12	10.5	10	11	11	11
Ear, length	23.5	26	25	23.2	28	26	26.5	25	26
Ear, breadth	15.8	20	19	20	18.5	19	20	22	22
Hornæboe, greatest breadth	17.2	18	18	—	17	19	18	—	—
Forearm	—	9	9	—	9	9	9	—	—
3rd metacarpal	61	63	64	58.5	61	60	61	59	59
4th metacarpal	45	44	44	—	42	42	44	44	43
5th metacarpal	42.7	43	43	—	42	40	43	43	41
Skull, total length to canine	39	38	40	—	38	37	38	36	36
Skull, basilar length to canine	—	24	24	23	23.5	24	23	23	22.5
Skull, zygomatic breadth	12.9	13	13	13	14	14	14	14	14
Skull, maxillary breadth	8.7	9	9	8.8	9.2	9	9	9.2	9.3
Skull, anteorbital breadth	6.2	6.2	6.5	—	6.5	6	6.5	6	6.5
Breadth across cingula of canines	6	6	6	6.1	6.5	6.3	6.2	6	6.9
Length of mandible	15	16	16	14	15.5	17	16	16	16
Upper tooth row, c-m ^s	8.3	8.6	8.8	8.2	9	9	9.5	9	9
Lower tooth row	9.1	9.9	10	9.4	10	10	10	10	9.5

lips which render it conspicuous, while in *caffer* it is less obvious, the opening consisting of an inconspicuous invagination of the skin with the margins haired, there being no naked lips.

It is to be hoped that an examination of considerably greater numbers of these large *Hipposideros*, collected at all seasons, will determine the constancy or otherwise of this character. It may be noted that Cansdale found his specimens inhabiting a house together with large numbers of *H. caffer*, that Lang and Chapin collected the typical series of *abæ* from amongst large numbers of *caffer* in caves, and that the two from the Ituri referred to *fuliginosus* were taken by the present author in a hollow tree with large numbers of *caffer*. The two distinct colour phases remarked on by Andersen for *fuliginosus* and by Allen for *abæ* are well represented by Cansdale's two skins.

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LXXV.—*New Species of Ants (Hym., Formicidæ) from the Island of Mauritius.* By HORACE DONISTHORPE, F.Z.S., F.R.E.S., etc.

Family **Formicidæ.**

Subfamily *MYRMICINÆ.*

Cardiocondyla mauritia, sp. n.

♀. Head, thorax and petiole light reddish brown, legs and antennæ lighter, clubs of antennæ, post-petiole and gaster darker brown.

Head rectangular, longer than broad, sides almost straight, posterior angles rounded, posterior border almost straight, very finely granulate, and furnished with very short decumbent yellow hairs; *mandibles* small, broad, triangular, masticatory border with a short pointed tooth at base, a longer, sharper tooth at apex, and four much smaller blunt teeth between; *clypeus* triangular, somewhat convex, anterior border rounded; *frontal area* indistinct; *frontal carinæ* short and straight; *eyes* fairly large and prominent, situated considerably in front of middle of sides of head; *antennæ* 12-jointed, *scape* not reaching posterior border of head, *funiculus* with first joint longer and broader than the following eight joints, *club* large, 3-jointed, first joint narrowed and considerably shorter than second, last joint longer than the two preceding taken together. *Thorax* longer than broad, narrower than head, broadest at anterior angles of pronotum, which are rounded, but distinct; no *suture* between pro- and mesonotum; *promesonotum* somewhat flat on disc, somewhat shining and more finely punctured than head; *suture* between mesonotum and epinotum well marked; *epinotum* with dorsal surface convex and longer than declivity, which is concave, armed with two well-developed, sharply-pointed teeth; *petiole* with a raised node, rounded in profile; *post-petiole* broad, transverse, rounded above and at sides, considerably broader than node of petiole; *gaster* long oval, narrowed to apex.

Long. 2 mm.

No. 102. Described from four workers taken by R. Mamet, Mauritius, 1941-1945.

Type in B.M. Coll.

Solenopsis mameti, sp. n.

♀. Dark yellowish brown, legs and antennæ lighter, gaster a little darker, very smooth and shining, whole body furnished with sparse, longer and shorter, yellow, outstanding hairs, more abundant on gaster.

Head subquadrate, slightly broader in front than behind, broadest about centre, posterior angles rounded, posterior border almost straight; *mandibles* rather long, narrow, masticatory border armed with three teeth, the apical one longest and sharpest, the two at the base shorter and blunter; *clypeus* narrow, triangular, bicarinate, the carinæ ending at anterior border in two small teeth, posterior border bluntly pointed, extending between frontal carinæ; *frontal carinæ* short, flat, not wide apart, slightly divergent posteriorly; *antennæ* 10-jointed, *scape* not reaching posterior border of head, *funiculus* with first joint longer and broader than the following short six joints, last two joints forming a large club considerably longer and broader than all those preceding, last joint pointed at apex, considerably longer, but as broad as the preceding one; *eyes* small, flat, situated at sides in front of middle of head. *Thorax* narrow, longer than broad, narrower than head, broadest in middle of pro-mesonotum; *prosternum* forming a neck, no suture between pro- and mesonotum; *promesonotum* oval, convex, rounded in front and at sides; meso-epinotal *suture* well marked; *epinotum* convex on dorsal surface, angle between dorsal surface and declivity rounded, dorsal surface longer than declivity, declivity concave. *Petiole* with a high node, rounded above, pointed in profile; *post-petiole* slightly transverse, broader than node of petiole, rounded above, in front, and at sides; *gaster* oblong oval, truncate at base.

Long. 1.8-2 mm.

♀. Colour the same as in the worker, but considerably larger in size; outstanding hairs more abundant. *Head* longer in proportion; *mandibles* with longer and sharper teeth; *clypeus* as in ♀; *antennæ* 11-jointed, otherwise similar in construction to ♀; *eyes* large and much more

prominent; *ocelli* present. *Thorax* long, narrow, dorsal surface rather flat; *promesonotum* rounded in front, considerably longer than broad, finely but not closely punctured; *præscutellum* narrow, transverse; *scutellum* short, round oval, smooth and shining; *metanotum* narrow, transverse, slightly raised; *epinotum* smooth and shining, dorsal surface flat, longer than declivity, with a very blunt tubercle at each side of angle between it and declivity, declivity concave; *petiole* with rather high node, rounded above, pointed in profile, posterior surface slightly convex; *post-petiole* transverse, rounded above and at sides, broader than node of *petiole*, anterior surface concave, posterior surface convex, a small, short, pointed tooth is present on under side; *gaster* long oval, pointed at apex, rather deeply excised at junction with post-petiole.

Long. 3.5 mm.

Described from 54 workers, and three dealeted females taken by R. Mamet on Corps de Garde Mt., Mauritius, December 26, 1945. The colony was nesting under a stone in a shady place. Larvæ were present, and also four specimens of a Bethyloid.

Type in B.M. Coll.

Triglyphothrix mauricei, sp. n.

♀. Reddish brown, mouth-parts, antennæ and legs pale brownish yellow; body clothed with moderately short and abundant outstanding brown hairs of different lengths and structure.

Head a little longer than broad, slightly narrower in front than behind, space between eyes and posterior angles straight, posterior angles rounded, posterior border very slightly and shallowly excised. Sculpture consisting of slightly raised longitudinally ridges, interrupted by cross striae, forming a network and enclosing irregular spaces. *Mandibles* massive, triangular, slightly striate and punctate, masticatory border armed with a sharp tooth at apex, preceded by a row of short and blunt teeth; *clypeus* large, triangular, dorsal surface convex and striate longitudinally, the margin of the posterior border raised, forming a strong carina, which forms the anterior border of the antennal foveæ, anterior border slightly excised in middle; *scrobes* shallow and smooth, extending back near to posterior border; *frontal area* and *furrow* wanting; *eyes* fairly large, round, and prominent, situated in about

the middle of sides of head; *antennæ* 12-jointed, *club* 3-jointed, *scape* curved, not reaching posterior border of head, *funiculus* with first joint subquadrate, next seven joints transverse, gradually increasing in width, first joint of club shorter and narrower than second, last joint slightly longer than the two preceding taken together. *Thorax* rather short, convex, robust, broader in front, narrowed behind, broadest a little behind humeral angles, which are slightly prominent, no sutures on dorsal surface; *epinotum* armed with two moderately long, sharp, divergent spines, declivity concave and smooth, with two short, sharp teeth, situated one on each side of base; the sculpture of thorax consists of a network of raised ridges, enclosing somewhat irregular spaces. *Petiole* with smooth peduncle, node rounded above and at sides, sculpture as in thorax; *post-petiole* slightly transverse, sides rounded, very slightly broader and sculpture finer than in petiole; *gaster* short oval, smooth, shining, excised at base at junction with post-petiole. *Legs* moderate, *femora* and *tibiæ* spindle-shaped.

Long. 2.5 mm.

No. 48. Described from three workers taken by Mr. R. Mamet at Rose Hill, Mauritius, in 1942.

This species comes near to the cosmopolital *T. striatidens* Emery, but is darker in colour, the sculpture of the petiole and post-petiole is considerably coarser, and the epinotal spines are shorter and straighter.

Strumigenys (Cephaloxys) raymondi, sp. n.

♀. Brownish redd, body clothed with scattered, not very abundant outst. lying, clavate hairs, and fine subappressed hairs situated chiefly on head. *Head* narrow, triangular, considerably narrower at apex than at base, broadest just before posterior angles, posterior angles rounded, posterior border sharply excised in middle, vertex somewhat convex, sculpture closely and finely granulate; *mandibles* narrow, not very long, slightly convex above and bent downwards at apex, base hidden beneath clypeus, masticatory border curved to a sharp, fine point at apex, rest of border without teeth, underside somewhat hollowed out; *clypeus* broad diamond-shaped, slightly raised, but rather flat, anterior border slightly projecting; *frontal area* indicated by a small, somewhat deep pit; *frontal furrow* very faint and short; *frontal carinæ*

slightly raised, sinuate behind, and continued along upper rims of scrobes, which are slightly serrate; *scrobes* situated above eye, and extending nearly to posterior angles; *antennæ* 6-jointed, *scape* curved and extending to end of base of scrobe, *funiculus* with first joint not quite as long as fourth, second and third very short, last joint long and pointed, nearly as long as the rest of the funiculus; *eyes* very small, situated beneath scrobes considerably behind centre of sides of head. *Thorax* rather shining, sculpture finer than that of head, longer than broad, broadest behind posterior angles, dorsal surface round, convex, considerably contracted at meso-epinotal suture; *pronotum* narrow, transverse, forming a neck in front, humeral angles slightly projecting, *mesonotum* furnished with two small teeth or projections at base before meso-epinotal furrow, which is transverse, smooth, and deep; *epinotum* armed with two small sharp, slightly divergent, projecting teeth, or spines, *dorsal surface* convex, somewhat longer than declivity, *declivity* concave. *Petiole* with a long narrow peduncle and short, slightly transverse node at base, rounded above and at sides; *post-petiole* rather broad, transversely elliptical, broader than node of petiole, convex, rounded, smooth and shining above; *spongiform appendages* fairly well developed, situated between petiole and post-petiole, and post-petiole and gaster, most prominent beneath post-petiole; *gaster* oblong ovate, smooth and shining except for a number of short longitudinal striæ at base; *sting* exerted. *Legs* fairly long.

Long. 2.5–2.7 mm.

♀. Colour, general structure, sculptured and hairs, as in ♀.

Mandibles slightly longer; *ocelli* rather small, situated on a small prominence on vertex of head; *eyes* large. *Thorax* broader and more convex; anterior angles of *pronotum* prominent; *suture* between pro- and mesonotum deep; *mesonotum* convex; *scutellum* convex and rather prominent; spines of *epinotum* stouter.

Long. 2.8 mm.

Described from a number of workers and two dealated females from Mauritius. All collected by Mr. Raymond Mamet as follows:—

No. 8. On Le Pouce Mt., 15 ♀♀, nesting in old, rotten tree stump, 24. xii. 1942. No. 12. Ditto, 36 ♀♀, and larvæ, 13. xi. 1943. No. 19. On Corps de Garde Mt.,

10 ♂♂, and 1 dealated ♀; caught on tree trunk, 17. i. 1944. No. 20. On Corps de Garde Mt., nesting in tree trunk, 55 ♂♂, larvæ and pupæ, 1 dealated ♀. No. 28. "Collected on Cocotte Mt." 18 ♂♂, 24. i. 1942.

Type and ♀ type in B.M. Coll.

Subfamily *DOLICHODERINÆ*.

Iridomyrmex vinsoni, sp. n.

♀. Shining black, with a distinct bluish metallic reflection in some lights, base of scape, knees and tarsi pale yellow.

Head long oval, longer than broad, narrower in front than behind, posterior angles rounded, posterior border slightly excised in centre; *mandibles* large, broad, triangular, with a few fairly large shallow punctures, masticatory border armed with four blunt teeth, and a long, sharp apical one; *clypeus* large, convex on disc, anterior border widely, but not deeply excised, sinuate at sides, forming a rather sharp angle with central area; *frontal area* triangular, small, not very distinctly defined; *frontal carinæ* short, flat, widely separated, divergent behind; *eyes* large, oval, rather flat, situated above sides, in about centre of head; *antennæ* 12-jointed, *scape* not quite reaching posterior border of head, *funiculus* with all the joints longer than broad, gradually increasing in breadth, last joint as long as the two preceding taken together. *Thorax* longer than broad, broadest about centre of pronotum; *pronotum* convex, narrowed to apex, forming a neck, sides rounded and finely margined, suture between pronotum and mesonotum fine, shallow, but distinct; *mesonotum* not very convex, slightly longer than broad, anterior border and sides straight, spiracles not very prominent, suture between mesonotum and epinotum deep, well marked; *epinotum* convex, rounded above, sides straight, angle between dorsal surface and declivity well marked, dorsal surface longer than declivity, declivity concave. *Scale of petiole* slightly inclined forward, thin, rounded above, sides rounded, narrowed to base, anterior and posterior surfaces flat; *gaster* convex, oval, pointed at apex.

Long. 2.8–3 mm.

No. 83. Described from four workers taken by J. Vinson at Les Mares, Mauritius, January 15, 1938.

Type in B.M. Coll.

Subfamily FORMICINÆ.

Pseudolasius dodo, sp. n.

♀. Reddish yellow, shining, gaster somewhat darker, whole body furnished with longer and shorter outstanding hairs.

Head a little longer than broad, sides and posterior angles rounded, posterior border excised in middle, *mandibles* long, rather narrow, masticatory border armed with six teeth, counting from the base first longer than second, third longer than first and fourth, fifth as long as third, but sharper, apical tooth longer and sharper than the rest; *clypeus* large, triangular, convex, anterior border straight, widely but slightly excised in middle, sinuate at sides, posterior border round, narrowly excised in middle; *clypeal foveæ* not confluent with *antennal foveæ*; *frontal area* not clearly defined; *frontal carinæ* short, almost straight and parallel; *eyes* black, moderate, round, situated on dorsal surface and about the centre of sides of head; *antennæ* fairly long, 12-jointed, *scape* extending a little beyond posterior border of head, *funiculus* with first joint longer and broader than those immediately following, last four joints longer and slightly broader than the rest, the first three of which are subequal in length, last joint longer than the two preceding taken together; *palpi* short, *maxillary palpi* 5-jointed, *labial palpi* 3-jointed. *Thorax* robust, longer than broad, broadest about centre of pronotum, narrower than head; *pronotum* transverse, convex, anterior border and sides rounded and narrowly margined; *mesonotum* round oval, convex, projecting; *metanotum* narrow, transverse, broader at sides, spiracles situated on each side of disc; *epinotum* large, transverse, convex, angle between dorsal surface and declivity rounded, declivity longer than dorsal surface, rather flat, spiracles round, somewhat prominent; *scale of petiole* erect, narrow, longer than broad, sides straight, anterior and posterior surfaces flat, upper surface straight, anterior angles abruptly rounded; *gaster* short, broad oval, rounded anteriorly, and somewhat overhanging scale, bluntly pointed posteriorly.

Long. 2.7-3 mm.

No. 81. Described from 24 ♀♀, taken on Le Pouce Mt., Mauritius, December 7, 1940, by J. Vinson.

Type in B.M. Coll.

LXXVI.—*Note on the Life-history of Trichostrongylus tenuis*
(Mehlis), *Nematoda*. By WALTER E. COLLINGE, D.Sc.

DURING the years 1930–32 I made a long and exhaustive investigation on the cause of Partridge Disease *, in which it was demonstrated that the nematode worm *Trichostrongylus tenuis* (Mehlis) was the cause.

In the course of this work I discovered that the whole of the life-history of this parasite could take place without the intervention of the host, a fact not hitherto known or believed to be possible.

It occurred to me that it would be interesting to take the eggs from the caecal content of an infected bird and endeavour to learn the length of time that the larval worm would live in such matter.

On March 4, 1932, a partridge badly infected with the parasite was opened, and a small quantity of the decomposing caecal content was removed on the end of a scalpel and placed in a Petri dish, which already contained a thin film of water on the bottom dish and a saturated piece of blotting-paper fitted into the upper cover.

The small mass of caecal content was well spread over the surface of the dish, and was found to contain numerous eggs in the morula stage and a few adult worms, some of which contained eggs.

On March 14 and 30 a small quantity of the material was examined, and large numbers of the larval worms were found to be present, all in an active condition.

On April 21 and 28, although the smear on the lower dish was perfectly moist, a few of the larvæ had commenced to retract the body at both ends from the cuticle, and little movement could be detected.

Various examinations were made during May and early June, but little change could be detected beyond the fact that the larvæ showed still less movement, and it was only after adding a drop of water to the slide and letting it remain there for about thirty minutes that the active, wriggling larvæ could be seen.

On June 18, although there was plenty of moisture present, the larvæ had undergone further retraction, but

* 'Partridge Disease and its Causes,' London, 1932.

soon resumed their movements on further water being added to the slide.

The contents of the Petri dish were now of about the consistency of glycerine, and in certain areas slimy green patches were developing.

The next examination was made on June 22. By now a thin green scum covered most of the surface of the dish and had spread to the blotting-paper in the covering dish. On the point of a needle a tiny portion was removed and placed on a slide. To my surprise I found large numbers of adult worms and very few of the larvæ. From this it seems clear that, without again entering the body of the partridge, the life-history had been completed in the cæcal content in the Petri dish.

It has been possible to carry this experiment still further. On July 6 an examination was made of various parts of the putrifying mass, which, by now, had become highly offensive, and smear after smear revealed the fact that the adult had laid numerous eggs and died, and the dish again swarmed with larval worms.

When recounting these observations to Dr. R. T. Leiper, he kindly checked my work, which was so unusual, and suggested that as I had been using tap-water the species might not be *T. tenuis*, but another one that was not parasitic in any animal. This, however, was not so, for I examined the cauda bursa in a large number of specimens, all of which were undoubtedly *T. tenuis*.

Using distilled water, I repeated my experiments in 1936 and 1937, and after many failures I again obtained results similar to those set forth above.

Recently I have again made a series of experiments, and have again corroborated my original observations.

Thus on four different occasions I have been able to work through the whole of the life-cycle of this parasite without the intervention of a host. It therefore seems possible, under artificial conditions, to trace the life-cycle apart from the partridge. It is not suggested for a moment that this would take place in a state of nature.

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[ELEVENTH SERIES.]

No. 96. DECEMBER 1945.

LXXVII.—*Studies of Acari, V.—Notes on and Descriptions of new and little-known British Acari.* By F. A. TURK, Ph.D., F.R.E.S., F.Z.S.

THE Acari of these islands are still very imperfectly known partly owing to the few British workers on the group and partly to the relative inaccessibility of much of the voluminous Continental literature. Even after the very careful pioneer researches of the late A. D. Michael, Dr. J. E. Hull and Mr. J. N. Halbert we are still far from anything like a complete picture of the acarine fauna of Britain, and many of the species that are recorded rest on single captures and often under names that are now invalid or open to doubt. For this reason I have, where it seemed necessary, appended notes on other members of the genus apart from those which are described here for the first time; I have also added, where more obscure genera were involved, and as far as my material and knowledge allowed, dichotomic keys to the other British species.

I have to thank several workers and friends for gifts of material, especially Col. A. E. Hammerton, Pathologist to the Zoological Society of London (for the new *Ichoronyssus* species sent to me at the same time as the valuable acarine material from the lungs of snakes, which I have dealt with in Series IV. of these Studies), Mr. Eugene O'Mahony of the National Museum of Ireland, and Mr. R. B. Freeman of the Bureau of Animal Population, Oxford.

MESOSTIGMATA.

Macronyssidae.

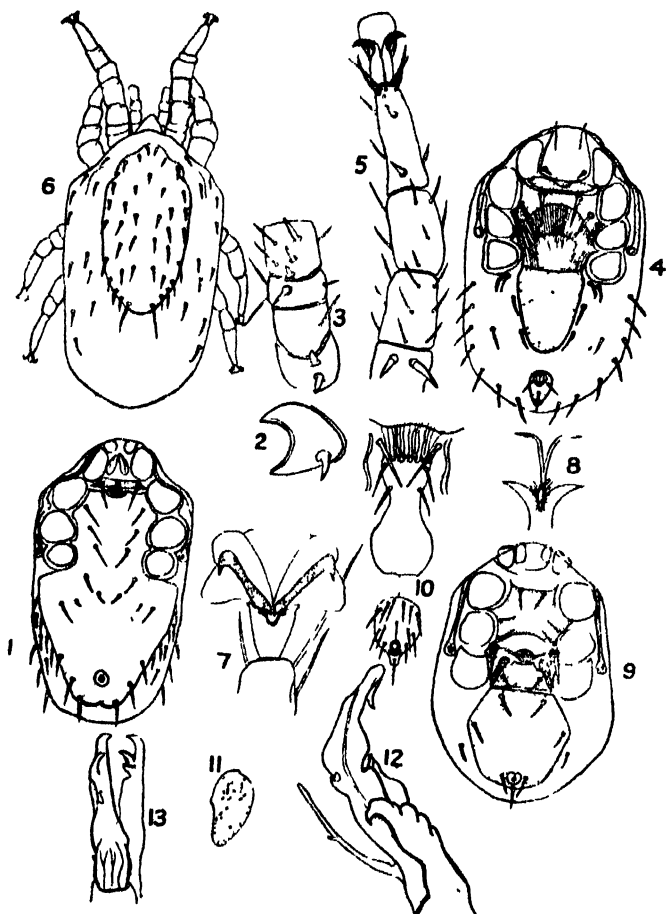
Dr. Flavio da Fonseca of Brazil informs me, in a recent letter, that he is engaged on a detailed revision of the mites of this family, which is to be published shortly and, that as a result of this work, he is reinstating most of Kolenati's genera. Until this work is completed the limits of the genera must remain somewhat difficult to define, but it seems that the species here described as new, is rightly to be placed in the genus *Ichoronyssus*. Kol.

Ichoronyssus orcadensis, sp. n.

Male.—Length 216μ , breadth 108μ , length of first legs 75μ . Colour of the examples preserved in spirit, a rather dark brown. The dorsal shield covers the greater part of the dorsum, leaving only a very narrow posterior margin of uncovered skin. The general appearance of the dorsum of the animal is very similar indeed to that of the male of *I. carnifex* (Koch) (= *I. albatro-affinis* Ouds.). There are spines on the 2nd, 3rd and 4th legs, that on the third being remarkably large (fig. 2). On the femur of the first pair of legs are two anteriorly directed and one posteriorly directed long spines. The rather peculiar arrangement of the spines on the second pair of legs is shown in fig. 3. The single spine of the coxæ of the third pair of legs is sufficient to distinguish this species from *I. carnifex*, in which the male has two spines on this coxa. The ventral surface (fig. 1) shows a very sinuate peritreme, rather markedly expanded between the second and third coxæ. There is a well-marked pre-sternal shield bearing a single pair of setæ and a very large holoventral shield. This latter has the usual three pairs of hairs on the sternal portion of this shield, and the ventral region is more expanded laterally than in any other species of the genus known to me—a character which will also serve to distinguish it from all others, although in several respects it is similar to the holoventral shield in *I. carnifex*. The arrangement of the setæ on this shield is shown in fig. 1 and, as will be seen, the anus is set rather unusually far back from the posterior border, which is slightly indented.

Female.—Length 264μ , breadth 144μ , length of first leg 108μ . Colour darkish brown. The dorsal shield is

Figs. 1-13.



- Fig. 1.—*Ichoronyssus orcadensis*. Male ventral.
 Fig. 2.—*Ichoronyssus orcadensis*. Coxa of the 3rd pair of legs of male.
 Fig. 3.—*Ichoronyssus orcadensis*. Arrangement of spines on the second pair of legs of the male.
 Fig. 4.—*Ichoronyssus orcadensis*. Female ventral.
 Fig. 5.—*Ichoronyssus orcadensis*. 1st leg of female.
 Fig. 6.—*Ichoronyssus orcadensis*. Deutonymph, dorsal.
 Fig. 7.—*Ichoronyssus orcadensis*. Tarsus of the second pair of legs of male.
 Fig. 8.—*Coproholaspis anglicus*. Epistome of female.
 Fig. 9.—*Coproholaspis anglicus*. Female ventral.
 Fig. 10.—*Hæmogamasus arvicolarum* (Berl.). Genito-ventral and anal shields of female.
 Fig. 11.—*Hæmogamasus arvicolarum* (Berl.). Metapodial shield of female.
 Fig. 12.—*Hæmogamasus arvicolarum* (Berl.). Chela of male.
 Fig. 13.—*Hæmogamasus arvicolarum* (Berl.). Chela of female.

not so large as that of the male, leaving a good deal of the dorsum uncovered. There are two anteriorly directed spines on the femur of the first leg (fig. 5) besides a very small posteriorly directed one, not shown in the figure, which is very much smaller than the similar spine on the first legs of the male. The tarsus of the first pair of legs also bears two short but stout spines placed as shown in fig. 5. There is only one anterior spine and no posterior spine on the femur of the second pair of legs. On the ventral side there is a very long and undulating peritreme which reaches nearly to the level of the anterior border of the hypostome. The hypostome itself bears in the posterior lateral angles two very strong spines which are easily seen in some specimens but in others difficult, or impossible to make out, for much of this material was very poorly chitinised. Posterior to the hypostome is a well-marked pre-sternal shield, but on none of my specimens can I find that it bears any hairs as is the case with the male: this is a most curious abnormality, and I do not think that it can be supposed to be a specific character. The sternal shield is concave in front and very strongly arcuate behind, and bears the usual three pairs of hairs which are very well marked and rather spinose. The genital shield is a very thin, highly transparent plate with fimbriate margins, and the ventral shield is broad and somewhat oblong, in shape and size rather different to that in other species of the genus (fig. 4). The anal plate is of the usual *Ichoronyssus* type and resembles perhaps most closely that of *I. isabellinus* (Oudemans).

Deutonymph.—Length 228 μ , breadth 120 μ , length of first legs 78 μ . Colour very light straw. The dorsal shield (fig. 6) is of the usual elongate oval shape: anteriorly it is crenulate with two marked indentations, a character which serves to distinguish it from *I. carnifex*. As in the last-named species there are six rows of setae on the dorsal shield and a pair of longer posterior ones. The single sterno-ventral shield is not abruptly angled behind as in *I. carnifex*, and does not reach further than the anterior border of the 4th coxa whereas, in the deutonymph of the last-named species, it reaches well behind the posterior border of the 4th coxa. Between the sterno-ventral and anal shields are only a few sparse weak hairs.

Type material.—From the Orkney Island Grass Mouse, *Microtus orcadensis* Millais, taken from a specimen which died in the Zoological Gardens, Regent's Park, and sent to me in July, 1945. One specimen each of male, female and deutonymph were selected and mounted on the same slide and constitute the types, which are in my collection.

Note on the Claws and Pulvillus.—There appears to be very little reference in the literature of Acarology to these structures in the Macronyssidae. Sellnick and Oudemans, in the 'Kritisch Historisch Overzicht der Acarologie,' III Series, Band A (1936), of Dr. A. C. Oudemans, mention, on page 289 of that work, a work by Metaxà (Monogr. de Serpenti di Roma, 1823), in which that author, referring to *Macronyssus natrix* (Gervais, 1844, says that the pulvillus is divided into two and the claws are retractile. He appears to be the first and only author to make this observation and he gives (for that early date) an extremely accurate figure. I have examined the claws and pulvillus of my species rather carefully, and I find that the claws are certainly retractile, and those of the first leg of the female are very similar to that shown in the figure given by Metaxà. This can be quite adequately seen from my fig. 5. It will be seen that the claws are relatively simple and not sharply angled and that the pulvillus is undivided and quite simple. Unfortunately I have not been able to make out the structure of the claws of the first leg of the male in my specimen, nor does the condition of other males of this genus in my collection make it possible to say what form the whole ambulacral apparatus may take. The second pair of legs of the male of the present species, however, show that the claws and pulvillus are markedly different. When retracted so that the pulvillus can be seen fully spread, as shown in fig. 7, they are obviously more sharply angulate, straighter and, at their apices at least, stouter. Moreover the pulvillus is lobed, a condition which I cannot make out in any female of the genus which I possess. Whether there are three or five lobes present I have not satisfactorily determined, as the line of demarcation between the outer ones is hidden by the claws in my mounted material but, judging by the shape of the outer border and the marked general similarity to the ambulacra of the Entonyssidae, a nearly related family, I should suppose there to be five lobes present. It would seem that

this difference in the ambulae of the second pair of legs should be looked upon as a secondary sexual character.

Relationships of I. orcadensis.—It has already been shown that this mite is very nearly related to *Ichoronyssus carnifex*. *I. carnifex* has been found on the mammalian genera *Talpa*, *Mus*, *Rattus*, *Microtus* (= *Arvicola*) and *Nyctalus* (= *Pterygistes*). It has been recorded from the continent of Europe and from the United States of America, where it has only been found on the house mouse and is without doubt an importation. Its most usual host on the Continent is probably *Microtus arvalis*, and in this connection it interested me to read what Hinton says in 'A History of British Mammals' by Barrat-Hamilton and Hinton (London, 1914), page 453: "The grass mice of the Orkneys belong to a peculiar group which appears to be an offshoot of a form not known in Britain, the Continental *M. arvalis*." This remark gives an added interest to the new species of mite described above, as not only does it add to the certainty of its descent from *I. carnifex*, but it shows the effect of geographical isolation on parasitic acari and the consequent speciation which must sometimes occur as a result. A somewhat related host species, *M. sarnius* Mill., occurs in the Channel Islands, and it would be most interesting to examine any species of *Ichoronyssus* which it may harbour: it is probable that it would be at least some variety of *I. carnifex*.

The British species of Ichoronyssus.—As far as I can discover there are no records (with one exception) of species of this genus having been taken in the British Isles. This exception is the record of *I. carnifex* Koch from *Mus musculus* given by Elton (1936). These specimens were taken from house mice in the Outer Hebrides and here the species is, no doubt, a recent importation as it is on this host in America. I have already recorded an hitherto undescribed species, *I. soricis* Turk, 1945, from the Lesser Shrew, and this is in several respects highly aberrant. In addition to the above I have a single female of *I. arcuatus* (Koch) taken from a young rabbit at Feock near Truro, Cornwall, in April, 1944. This is a very unusual host for this species and, in fact, I do not think that it has been recorded from the rabbit before. Koch took the type from *Noctula noctula*, and it has since been recorded on various other bats and on the mole. These, then, constitute the only known records of British

species of this genus, and they may be separated as follows :—

Nymphs.

1. Dorsal shield small, its lateral margins not touching the sides of the body and showing a certain crenulation anteriorly. *I. orcadensis* Turk.
- 1a. Dorsal shield small but without crenulations anteriorly *I. carnifex* (Koch).
- Dorsal shield larger, covering all the anterior part of the animal and not crenulate in front 2.
2. Coxa 2 with two posteriorly directed spines and the femur with one dorsal spine.... *I. soricis* Turk.
- Coxa 2 with one posteriorly directed spine and the femur with two dorsal spines.... *I. arcuatus* (Koch).

Males.

1. Ventri-anal portion of the holovenal shield reaching nearly to the sides of the body at its broadest, and with the hairs on this portion implanted in transverse rows *I. orcadensis* Turk.
- Ventri-anal portion of the holovenal shield narrow, leaving a wide margin of uncovered skin at the sides of the body, and with the setæ of this part arranged more or less in two longitudinal rows.... 2.
2. The fixed ramus of the chela drawn out into a very long slender spine; coxa 1 with a backwardly directed spine-like tubercle... *I. soricis* Turk.
- The fixed ramus of the chela not produced into a spine-like slender process; coxa 1 without a tubercle..... 3.
3. Coxa 2 with one anteriorly pointing spine and one backwardly pointing one; coxa 3 with two backwardly and one outwardly directed spines..... *I. arcuatus* (Koch).
- Coxa 2 with one spine forwardly directed; coxa 3 with two posteriorly pointing spines..... *I. carnifex* (Koch).

Females.

1. A pre-sternal shield present..... *I. orcadensis* Turk.
- No pre-sternal shield present..... 2.
2. Dorsal shield wider, with curved margins *I. arcuatus* (Koch).
- Dorsal shield narrower, with nearly parallel margins *I. carnifex* (Koch).

(The female of *I. soricis* is unknown.)

Macrochelidæ.

Copropholaspis anglicus, sp. n.

Of this species I possess a single female taken under wet wood at Reskadinnick, near Camborne, Cornwall, 10. vi. 41.

Length 850 μ . The shape of the body is somewhat ovoid and much expanded behind the 4th coxæ. The dorsum is almost completely covered with a single shield, on each side of which are three rows of rather remarkably long setæ. These are all simple, stout, reflexed backwards and acutely ended. On the femur of the 1st pair of legs are two short, stout, dorsal spines, of which the outer one is slightly the largest; they are implanted transversely, close to each other but with their bases separate. The epistome (fig. 8) is quite distinctive: the forked apical piece is implanted in a forked lamellar base and, at the site of the implantation, the apical piece is slightly swollen and has a few sparse long setæ. The paired pieces of the forked base are unusually short and stout, for in most species of this genus they are more prolonged and tapered. The ventral side (fig. 9) shows the usual straight peritreme reaching, posteriorly, just to the level of the anterior border of the 4th coxæ. The sternal shield is of the usual type with three pairs of setæ. The arrangement of the shields around the genital opening is best described, with reference to the terms used by Prof. Trägårdh, in his important paper (Trägårdh, 1938), in which he treats of the morphology of these structures in *Macrocheles*. The metasternal shields are moderately large and unusually heavily chitinised and bear exceptionally long setæ—longer than those of the sternal shield. An easily seen median shield is present, as in the genus *Veigaia*, but in *Macrocheles* this is absent. This character thus provides a further connecting link between the *Macrocheles* complex and *Veigaia*, for Trägårdh (*loc. cit.*) says, "It is obvious that *Veigaia* and *Macrocheles* are closely related." A pair of oblique bar-shaped sclerites are present and these are, as described by Trägårdh, wider anteriorly. The epigynal shield itself bears the usual single pair of hairs. In this species the dorsal wall of the vagina shows a rather curious character, which does not seem to have been mentioned by previous authors; it appears to be divided by an angular incision into two plates at the level of the median plate. At the time of its capture an egg was just about to pass out of the vaginal orifice, and I cannot be sure that this is not an unnatural rupture of the membrane, but as it is symmetrical on both sides of the median plate, it would seem that such a structure truly exists but is,

perhaps, only to be seen when the parts are distended in the act of oviposition. The epigynal and ventri-anal shields are not contiguous, and the latter is broader and more trapezoid than in most other species of the genus. The arrangement of the setæ on this shield are best made out from the fig. 9.

Type: a single female, mounted, in my collection.

The British Species of Coprophilaspis.

Falconer (1923) listed two species of this genus, namely, *C. glaber* (Müll.) and *C. pisentii* (Berl.). The former of these names he obviously took from Hull (1918), but what this species may be I cannot say. It has proved impossible for me to trace Müller's original description, and this species is not mentioned in the Kritisch Overzicht der Acarologie of Oudemans. Hull says of it that it occurs everywhere in manure and is almost always one of the passengers on *Geotrupes* sp. In the south of England the only species which I find on *Geotrupes* is *C. vagabundus* (Berl.). Although Hull collected his material in the north of England I think that it is very unlikely that he had a different species before him and, indeed, he goes on to say (*loc. cit.*): "Berlese appears to identify it with *badius* Koch, which I think is a mistake. Oudemans, on the other hand seems to consider it identical with Berlese's *vagabundus*!" I cannot trace any reference to this opinion of Oudemans' and Hull, unfortunately, does not give one. Under the circumstances it appears to be best, for the present at any rate, to treat this species as *vagabundus* Berlese.

The British species of the genus may be keyed thus:—

- | | |
|---|---------------------------------|
| 1. Basal branches of the epistome apically bifurcate | <i>C. pisentii</i> (Berlese). |
| Basal branches of the epistome apically simple | 2. |
| 2. Ventri-anal shield broad and roundly truncate posteriorly, and with two pairs of setæ on the ventral portion | <i>C. anglicus</i> mihi. |
| Ventri-anal shield acuminate posteriorly, and with three pairs of setæ on the ventral portion | <i>C. vagabundus</i> (Berlese). |

(Note.—Between *C. anglicus* and *C. vagabundus* there is another significant difference which seems to have escaped notice hithert. Trägårdh (1912) says (p.556), speaking of the epistome: "Even with the use of oil immersion I have failed to see that the trunk of the median appendage continues underneath the fish-tail. It is a prolongation of the edge of the fish-tail itself." This appears to me to be the condition of this structure in *C. pisentii* as well, but in *C. anglicus* the apical part

is very definitely imbedded in the basal portion as I have described above, and as is shown in my fig. 8. It is extraordinary that several patterns of construction should exist in the epistomes of similar shape in this genus, for Oudemans (1928) describes a third type in *C. buruensis* Oudemans, 1927, from the island of Buru, Dutch East Indies. In this species there are three plates to the epistome placed one above the other, the median one of which is seemingly homologous with the apical portion of the epistomes of the European species. In *buruensis* it arises from the ventral side of the dorsal plate of the basal portion and, as in *anglicus*, its proximal part bears very fine hairs. Most probably the condition seen in Oudemans' species is the most primitive, and the epistome characteristic of *anglicus* has arisen by the fusion of the two basal plates of *buruensis* leaving the apical piece embedded in the basal. Still further fusion of the embedded portion would result in the epistome such as is found in *vagabundus* and *piscitii*!

Hæmogamasidæ.

Haemogamasus arvicolarum (Berlese, 1921).

Berlese (1921) described very briefly, and without figures, a form of this genus which he named *Hæmogamasus horridus* var. *arvicolarum*, taken from the nests of voles (*Microtus arvalis*) at Ferrara, Italy, and at Asuni in Sardinia. Since the publication of its description no subsequent author appears to have noticed this mite. In 1944 Mr. Eugene O'Mahony, of the National Museum of Ireland, sent me a large amount of material, comprising the adults of both sexes, of an *Hæmogamasus* taken from the nest of *Apodemus sylvaticus sylvaticus* (Linn.) 28. x. 1939, at North Bull, County Dublin, Eire. These appear to me to belong most certainly to Berlese's variety, and because of their many differences to *H. horridus* Michael, the fact that they are restricted in their habitat to the nests of voles and field mice, and do not apparently occur along with the type, *H. horridus*, and that their distribution is probably that of a Lusitanian species, they constitute, in my opinion, a distinct species. That this is, in fact, a Lusitanian species is made more probable by the fact that, having re-examined all my material of *Hæmogamasus horridus* Mich. from the nests of mice in England, I find that they are all without doubt to be rightly referred to Michael's species and show no variation in the direction of Berlese's description of his form; as no other continental worker appears to have noticed *H. arvicolarum* it would seem that the species is restricted to Ireland and the Mediterranean area and thus, very probably, a Lusitanian form. There is, indeed, no very great degree of special adaptation to specific hosts in this

genus (for instance, I have records of *H. hirsutus* Berlese from the mole, the common shrew and the nests of field mice) and there is, therefore, nothing very surprising in the fact that the species now brought forward once again should be found on a different host in a different part of its range.

Berlese's description is really too short to make a certain identification at all easy but, nevertheless, it seems to me that there are three main points of agreement on which one can rely. These are that it is said to be somewhat smaller than *H. horridus*, that the posterior abdominal hairs in the male are all of a fairly uniform length (none of the longer ones of the latter species are to be found) and that the hairs on the underside of the segments of the second pair of legs in the male are developed into spines, being markedly stronger than the hairs found elsewhere on the legs. All these three characters are shown in the Irish material, and although there are slight discrepancies between Berlese's account of the male chelæ and that which I have found in the former, I do not think there can be any reasonable doubt of their identity.

The length of the female is 1,300 μ . The sternal shield is shaped almost exactly as in *horridus* and with the same exceptionally long setæ on it. The ventral shield (fig. 10) is rather more similar to that of *H. nidi* Mich. than of *H. horridus* although, of course, the present species is at once separated from the former of these two by the sternal and anal shields. Two long characteristic setæ are placed at the sides of the genital area of this shield, and the anterior part of the shield itself carries two pairs of spines. In those individuals in which the ventral shield is found fully chitinated, the truncate posterior border is seen to be produced to a very slight median point. The anal shield (fig. 10) is rather larger than in *H. horridus*, with the well chitinated anal opening set rather far back. This shield carries, on all the females which I have examined, fourteen setæ, arranged as shown in the figure. The anal shield in most individuals of *H. horridus* carries this number of hairs, although some may be found with as few as nine only. The metasternal shields of the female are characteristic of the species, and their shape is best made out in fig. 11. The chelæ of the female are, as Berlese says, stronger and better chitinated than in *H. horridus*; the fixed digit has a strong, partly recurved apical tooth (fig. 13) and, a little

distance down the body of the digit and facing inwards, two stronger lateral teeth; immediately posterior to these teeth the digit widens considerably for a quarter of its total length, and this wider part is followed by a slight notch. The movable digit ends in a stout recurved tooth, posterior to which is a longer, thinner, curved tooth pointing anteriorly, and immediately behind this a very small posteriorly pointed tooth, which is very difficult to make out on most specimens. There is a slight indentation immediately underneath the anteriorly pointed, subapical tooth. The whole chela of the female is more elongate than that of *H. horridus*, a very easily seen difference.

The male is very like the male of *H. horridus*, with the exception of those differences mentioned by Berlese, which have already been quoted at the commencement of this description; in unprepared specimens these form the most ready means of distinguishing this species from *horridus*. The male chelæ (fig. 12), however, are different in many ways and, from the material which I have examined, they seem to show an almost absolute uniformity from specimen to specimen. The apical part of the fixed digit has a very well developed and definitely recurved apical tooth, and below this is a three-lobed membranous appendage. In Michael's figure of the male chela of *H. horridus* (Michael, 1892) there is a very faint indication of two indentations on the upper part of the shaft of this digit, and it is to be supposed that the three well-developed lobes found here in *H. arvicolarum* are a further development of this. The differences in the movable digit in both species are very considerable. The body of this digit, the part, that is, which lies just a little in front of the point of origin of the great hooked apical process, which is indicated in Michael's figure (*loc. cit.*) of *horridus* only as a short line seemingly joining the movable to the fixed digit, is, in *arvicolarum*, produced into a broad lamella ending anteriorly in a long acute tooth, the whole reaching in front of the level of the hooked beak-like process of the fixed digit. The very curious apical portion of the movable digit is best seen in fig. 13 and, comparing this with Michael's figure of *H. horridus*, it will be seen to be very much broader at its base and more markedly tapered; also the recurved portion is not, proportionately, so long as in *horridus*. The "spermatophorenträger" of *arvicolarum* is much longer and more slender than in *horridus*, and about the

middle of its length it bears a well-marked tooth, which the latter species certainly does not possess.

The average length of the males which I have examined is 1200 μ .

The following table will serve to distinguish the British species of *Hæmogamasus* :—

Females.

- | | |
|--|------------------------------------|
| 1. Sternal plate with numerous hairs..... | <i>H. hirsutus</i> Berl. |
| Sternal plate with only three pairs of hairs. | 2. |
| 2. Sternal plate very strongly concave posteriorly; body hairs sparse..... | <i>H. oudemansi</i> Hirst. |
| Sternal plate trapezoidal or only slightly concave posteriorly; body hairs set close together..... | 3. [<i>michaeli</i> Oudemans. |
| 3. Hairs on anal plate always few in number. Hairs on anal plate never less than nine in number .. | <i>H. nidi</i> Michael = <i>H.</i> |
| 4. Genito-ventral plate somewhat flask- or vase-shaped, expanded posteriorly..... | 4. |
| Genito ventral plate oblong with almost straight sides and truncate posteriorly.. | <i>H. arvicolarum</i> Berl. |
| | <i>H. horridus</i> Michael. |

Males.

- | | |
|--|--------------------------------|
| 1. Ventral setæ sparse, the distance between their bases nearly the length of a seta.... | <i>H. oudemansi</i> Hirst. |
| Ventral setæ numerous and very close together..... | 2. |
| 2. Movable digit of the chela only a very little longer than the fixed digit..... | 3. |
| Moveable digit at least half as long again as the fixed digit of the chela and produced into a long recurved process..... | 4. |
| 3. Larger species (always more than 1000 μ); all teeth on both digits of the chelæ ending bluntly - generally completely rounded.. | <i>H. hirsutus</i> Berlese. |
| Smaller species (never more than 850 μ , generally less); all teeth on both digits of the chelæ sharply pointed..... | <i>H. nidi</i> Michael. |
| 4. Some of the posterior abdominal hairs longer than the others; setæ on the underside of the second pair of legs similar to all other setæ on the legs..... | <i>H. horridus</i> Michael. |
| All the posterior abdominal hairs equal and similar; setæ on the underside of the second pair of legs thickened and spine-like..... | <i>H. arvicolarum</i> Berlese. |

Spinturnicidæ.

The British Species of Spinturnicidæ with the Description of a new Species, Spinturnix omahonyi, sp. n.

As the result of studying material collected by myself from the Pipistrelle and long-eared bats, besides several

mounted specimens of various species kindly sent to me by Mr. O'Mahony of the National Museum of Ireland, and Mr. Freeman of the Bureau of Animal Population, Oxford, I have now been able to study examples of all the species of this family which have, so far as I am aware, been recorded from the British Isles. In addition to this I am now able to give a short description of the male of *S. plecotinus* (Koch) which, I believe, does not occur in any previous paper, add *Periglischrus rhinolophinus* (Koch) to the British list, and describe an apparently new species, which it gives me much pleasure to name after Mr. O'Mahony, who has helped me in many ways with gifts of specimens.

The mites of this family are nearly always to be found on the wing membranes of their hosts. The British species are recorded in three papers, the last two of which are very short and little more than the bare records; these are Hirst (1927) and Thompson (1935 and 1936). Hirst records *S. euryalis* (Can.) from *Rhinolophus ferroequinum*, *S. vespertilionis* (Linn.) from *Myotis daubentoni*, *S. plecotinus* (Koch) from *Plecotus auritus* and *S. acuminatus* (Koch) from *Nyctalus noctula* and *Pipistrellus pipistrellus*. Thompson (1935) records *S. murinus* Walckenaer from *Myotis mystacinus* and a *S. sp.* from *Eptesicus serotinus*. Of this last he says: "Concerning these specimens Dr. Vitzhum writes that the species is known to him but cannot be given a name from the literature: it is in all probability one of the scarcely distinguishable species described by Kolenati." The same author, in his 1936 paper, records *S. vespertilionis* (Linn.) from *Myotis daubentoni* and *Myotis mystacinus*. Of the above species, which I have seen, all have been from similar hosts, with the exception of *S. plecotinus* (Koch), which occurred along with *S. acuminatus* (Koch) on *Nyctalus noctula* taken near Oxford and sent to me by Mr. Freeman. A species now newly recorded from the British Isles is *Periglischrus rhinolophinus* (Koch) which was sent to me for examination by Mr. Eugene O'Mahony. It was taken by Major C. E. Rutledge from *Rhinolophus hipposideros minutus* captured at Cloonee Ballirobe, Co. Mayo, Eire, August 1942. Murray (1876) considered this to be synonymous with *S. asema* Kolenati, and I believe this view to be most probably correct.

All the above species of Spinturnicidæ, including the new species described below, may conveniently be keyed as follows :—

- | | |
|---|-----------------------------------|
| 1. One dorsal shield in adult..... | <i>Spinturnix</i> . 2. |
| Two dorsal shields in adult..... | <i>Periglischrus</i> . 7. |
| 2. Digit of male chela without teeth..... | 3. |
| Digit of male chela with teeth..... | 4. |
| 3. Dorsal shield subcircular | <i>S. euryalis</i> (Can.). |
| Dorsal shield posteriorly, markedly acumin-
ate | <i>S. onahonyi</i> , sp. n. |
| 4. Three pairs of hairs before the dorsal
shield | <i>S. plecotinus</i> (Koch). |
| Four pairs of hairs before the dorsal shield. | 5. |
| 5. All the hairs on the ventral side of at least
the first pair of legs, small and relatively
weak | <i>S. vespertilionis</i> (Linn.). |
| Some of the hairs of the outer row on the
ventral surface, of at least the first pair
of legs, longer and relatively stronger .. | 6. |
| 6. Male sternal shield occupying nearly all
the space between the legs; posterior
ventral abdominal hairs long and
plentiful | <i>S. murinus</i> Walckenaer. |
| Male sternal shield very much smaller;
posterior ventral abdominal hairs short
and sparse | <i>S. acuminatus</i> (Koch). |
| 7. One species only in the British Isles..... | <i>P. rhinolephinus</i> (Koch) |

(Note.--There has been some doubt among acarologists as to the correct genus for *S. euryalis*. Radford (1943), presumably following Oudemans, has listed this under the genus *Periglischrus*, but the specimen which I have myself had under examination agreed exactly with the figure and description given by Hirst (1927) and quite definitely had only one dorsal shield. Supposing Hirst to have rightly identified his specimens with Canestrini's species, and there is little doubt as to that, then it seems clear that the species must be regarded as belonging to the genus *Spinturnix* although, perhaps, a somewhat aberrant form.)

Description of the Male of S. plecotinus (Koch).

I have received for examination specimens of the male of this species from both Mr. Freeman and Mr. O'Mahony. The length varies between 720 μ and 860 μ , a rather large variation. The sternal shield is beautifully sculptured, more markedly in some specimens than in others, and thus differs from the female. The longer hairs on the ventral side of the legs in the female are arranged exactly the same on the first pair of legs in the male, but on the remaining legs they are very much reduced in number and variable in length in different specimens. The spool shaped hair by the ambulatorium, which is found in the female, is not much in evidence in the male, as a rule, but on one of the Irish specimens it could be seen very distinctly indeed, on

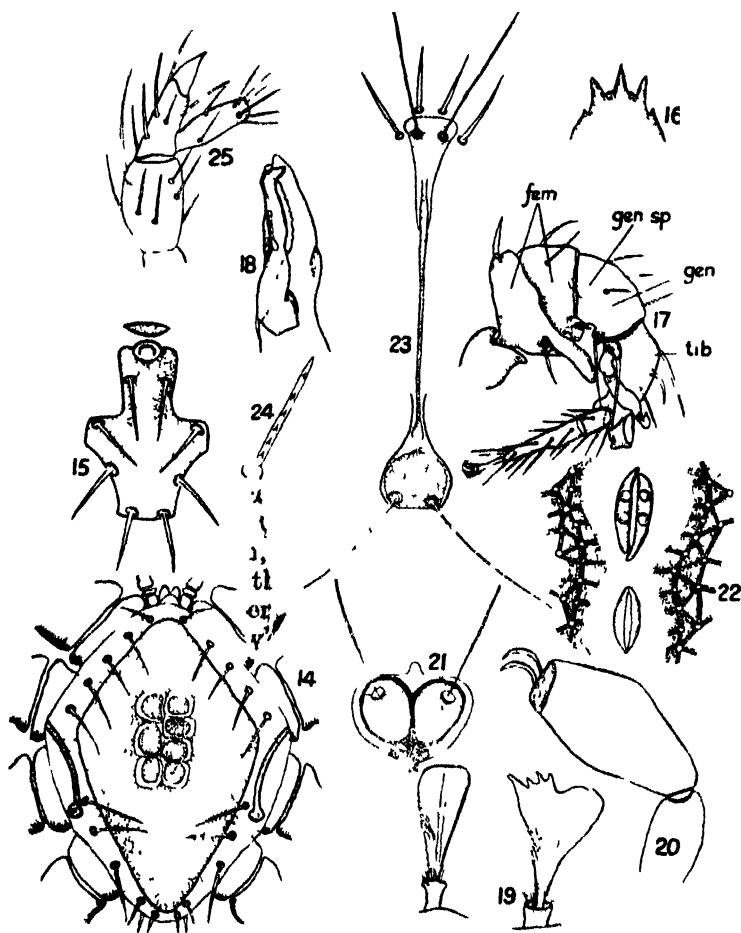
the first pair of legs. There are six hairs before the dorsal shield in the male as in the female, and in the former sex they are a little longer and stronger.

Spinturnix omahonyi, sp. n.

Only the male of this species is known. In some ways it is similar to *S. euryalis* but is easily to be separated by the foregoing key to the British species. The dorsum (fig. 14) is characteristic; the dorsal shield is unusually acuminate posteriorly and in the marginal uncovered portion of the dorsum are four pairs of hairs anteriorly (excluding the vertical hairs) and three pairs posteriorly. The extreme posterior hairs are sparse and small. In the middle of the dorsum is a very marked and very beautiful reticulation, the meshes having wide clear borders. In the type-specimen these reticulations are asymmetrical in their arrangement, there being four on one side and only three on the other. This whole structure seems to have nothing to do with the "pits" which are found on the dorsal shield of other species. In the balsam-mounted type-specimen I have not been able to make out their more detailed structure, and cannot hazard an opinion as to either their origin or function. The peritreme is somewhat short.

Ventrally the jugal plate is an anteriorly flattened ellipse (fig. 15) and the sternal shield (fig. 15) is quite diagnostic of the species. The anterior pair of hairs on this shield are as long as those of the other three pairs, but in *S. euryalis* they are decidedly the longest. The sternal shield itself differs from the last named species in having the anterior lateral angles all more or less right angles. The posterior lateral sides are arcuate and incurved, and the posterior margin very slightly convex. The posterior ventral abdominal hairs are very numerous and very long, and give the animal a definitely shaggy appearance in this region of the body. Total length 520μ , breadth at the widest part 400μ . Type a single male taken from the body of *Rhinolophus hipposideros minutus* (Montagu) at Devizes, Wiltshire, 6. x. 1944, and now deposited in the collection of the National Museum of Ireland, Dublin.

It is possible, of course, that this species is, in fact, one of the numerous species described by Kolenati, but as the exact determination of many of these must remain impossible



- Fig. 14.—*Spinturnix omahonyi*. Dorsum of male.
 Fig. 15.—*Spinturnix omahonyi*. Sternal and jugular shields of male.
 Fig. 16.—*Pergamasus crassipes* var. *longicornis* Berl. Epistome of male.
 Fig. 17.—*Pergamasus crassipes* var. *longicornis* Berl. 2nd leg of male.
 (fem. = femur; gen. sp. = genual spur; gen. = genu; tib. = tibia.).
 Fig. 18.—*Pergamasus crassipes* var. *longicornis* Berl. Chela of male.
 Fig. 19.—*Trombidium mediterraneum* Berl. Dorsal trichomes.
 Fig. 20.—*Calyptostoma lynceum* Berl. Tarsus and apex of metatarsus
 of the first pair of legs.
 Fig. 21.—*Calyptostoma lynceum* Berl. Pseudostigmatic organ.
 Fig. 22.—*Calyptostoma lynceum* Berl. Genital and anal apertures.
 Fig. 23.—*Erythraeus penninus* (Hull.). Crista.
 Fig. 24.—*Erythraeus penninus* (Hull.). Dorsal seta.
 Fig. 25.—*Erythraeus penninus* (Hull.). Terminal segments of palp.

and even an approximate one unlikely in several cases, seeing that identity of host is no real guide to the identity of the mite in this group, it seems better to describe it with a new name. In this connection a further note on *S. euryalis* may be appended. This species has, by some authors, been treated as a synonym of *Periglischrus interruptus* Kolenati, 1856, the type of which was taken from *Rhinolophus blaisii* Peters. Canestrini took the type of *euryalis* from *R. euryale* Blasius, which is the most nearly allied form to the former species but which has a more western and northern range. It has been shown above that the form which both Hirst and myself have seen, and which we take to be the *euryalis* of Canestrini, is a true *Spinturnix*, and it seems unlikely that Kolenati would have placed his species in the wrong genus seeing that he is the author of the genus *Periglischrus*.

Parasitidæ.

1'
11

Pergamasus crassipes var. *longicornis* Berl.

This, the commonest of the free-living Gamasids found in Britain, is also perhaps the most variable. Hull (1918) says, after his record of this form: "Also two or three other forms with variations of the patellar spur, especially a small spring form (male, 1 mm.) in which this spur is hardly visible from above." The spring forms of the males, as I find them, are certainly smaller than those found later in the year and appear, moreover, to be mature adults, but I have found none in which the patellar spur is as reduced as Hull describes, and I think that quite possibly this may only be found in the north of England, where Hull mostly collected. Trägårdh (1912) figured and described the form found in the French caves, and the same author (1931) described a form of this variety from the Faroe Islands and established at the same time that the armature of the second pair of legs in the male varies independently of the form of the chelæ. Specimens from Juan Fernandez have also been described, again by the same author (Trägårdh, 1931a), which differ in the details of the chelæ but have the second legs of the male agreeing with the typical variety figured by Berlese. Nearly allied to *P. crassipes* are several other species which with it form a group well separated from the rest of the species in the

genus. This group may be said to comprise, besides *P. crassipes* (Linn.) and its varieties, *P. corporaali* Oudemans, *P. equestris* (Koch), *P. canestrinii* (Berl.), *P. italicus* Oudemans and *P. probsti* Oudemans possibly, too, *P. mediocris* Berl. should be included here. None of these latter species have as yet been found in Britain, and of this group we have only *P. crassipes* type, recorded from Ireland, and *P. crassipes* var. *longicornis* Berl. common everywhere.

Of this last variety there are several forms in Britain, including the one figured and described by Trägårdh (1912) from the French caves. Besides the usual forms, I have one of the Spring forms mentioned above, taken at Treliassick Woods, Feock, 30th April, 1945, which represents in many respects the extreme development of the armature of the 2nd legs of the male together with the greatest reduction yet recorded of the accessory teeth of the chelæ. The length is $1,020\ \mu$ (Berlese gives $1,050\ \mu$ in his description of the variety) and the epistome (fig. 16) is well developed and with five teeth, the small extreme lateral ones being well marked. On the second legs of the male (fig. 17) all the spurs are better developed than in the other forms. The "low ridge," which Trägårdh (1912) says, "evidently acts as a check to the processus genualis," is continued right across the femur and appears, at first sight, to subdivide it. It is probable that it acts as a supporting rod to the extremely large femoral spur. At the distal end of the femur is another process, hitherto undescribed in this variety, which is short, highly chitinised and which ends truncately. On its inner side it bears a stiff blade-like hair, which arises at its base. The spur on the genu is further removed from the plane of the main femoral spur than is usual, and it ends in a more or less rounded knob. In the figure (fig. 17) this is shown in dotted lines. At the distal end of this segment also, there is a new process in the form of a setiferous tubercle, very strongly chitinised. The proximal tibial spur is very much longer than in any other form and is rather more complicated in its appearance. The basal lobe is developed into a longish, well-marked, setiferous tubercle; the hair which it bears is very long and strong, and nearly equals in length that of the spur itself. The latter is somewhat convoluted and thinner than in either the French or Faroese forms, and in

some respects looks more like that from Juan Fernandez. The end of it is recurved into an harpoon-like point. The ventral distal process of the tibia is of great width and sub-bilobate, as described by Berlese in his diagnosis of the variety *longicornis*.

The chelæ, too, are very different from any description given by previous authors of the forms they have seen. The fixed digit is rather more like the forms from the Faroes and the moveable digit like that of the French cave forms. All the teeth are very much reduced on both digits, those on the moveable digit being little more than slight tubercles. It is just possible that the teeth on this specimen may be worn down by use, a fact made more likely by the apparent absence of the "pilus dentarius"—the small hair on the fixed digit. However this may be, the shape of the two digits, as shown in fig. 18, is sufficient to characterize the form. As there is little doubt but that intermediate forms exist, there seems to be no reason for giving this extreme variation any name other than var. *longicornis* Berl., but it is of considerable interest, in view of what has already been written on this species by other authors, as marking the extreme development of the armature in the second pair of legs in the male.

New British Records of Mesostigmata.

Eugamasus kræpelinii Berl.—A male and several females of this uncommon species were sent to me by Mr. C. Fenton of the Forestry Dept., Oxford University. They were taken from the litter of a Douglas Fir in Bagley Wood, Oxford, 7. xi. 45. In my examples the epistome of the male is not constricted behind the three lobes and is exactly the same as the female ones. Sizes of my examples: ♀ 650 μ , ♂ 550 μ .

Hypoaspis oblongus Halbert.—This was taken with a great number of *Tyroglyphus dimidiatus* (Herm.) which were found infesting *Elpenor* larva by Mr. Ticknell at Oxford in 1945, and were sent to me by Dr. Hobby for identification. The specimens agreed quite well with Halbert's description especially as regards the markings on the dorsal shield. They differ, however, in three minor ways: (1) the shape of the anal shield, the fore-margin of which is longer than either of the other two sides; (2) the ventral shield of the female is broader in proportion to its width; and (3) the peritrematic shield in several of these

specimens could be seen to be separate from the parapodial shield, and it is the latter which is prolonged backwards. No doubt such specimens are ones which have recently moulted, and in older ones the scuta tend to coalesce and assume the condition seen in Halbert's figure (Halbert, 1915). The type-specimen was taken in Ireland under the bark of decayed trees.

Androlaelaps hermaphrodita (Can.), a female of this species, was taken in the nest of *Apodemus sylvaticus sylvaticus* (L.), at North Bull, County Dublin, 28. x. 39, and was sent to me by Mr. O'Mahony. It has been recorded by Hull (1925) from Northumberland, who also figured the female. This is, therefore, the first record for Ireland. The Irish specimens differ from Hull's figure in that the sternal shield is more elongate and the reticulations on it not so small. The average length of the Irish specimens of the female was 820 μ .

Phaulocylliba romana (G. and R. Can.).—This is the first record of this species from the British Isles. Several hundred pedunculate nymphs were found attached to a specimen of the woodlouse, *Porcellio laevis* Latr., collected by L. W. Grensted at Oxford, 16. vi. 1937. One hundred and twenty seven specimens were fixed to the host when I examined it, and many more were at the bottom of the tube. Zasukin, Ioff and Tiflov (1935) say that Dr Schulze has told them that Prof. Martini has communicated to him the fact (*in litt.*) of counting more than 600 Uropodid mites on one woodlouse. The only other British species of the genus is the halophilous *P. littoralis* (Troues.).

Dermacentor reticulatus (Fabr.).—A female of this species of tick was taken from the leg of a child whilst walking through an orchard at Polbathick, near St. Germans, 5. iii. 44, and sent to me by my friend, Mr. H. C. Fountain, F.Z.S. By far the greatest number of British records of this tick, whose usual host is the sheep, have been from S.W. Devon, and it is possible that this area of its greatest concentration extends across the river Tamar into the S.E. corner of Cornwall.

TROMBIDIIFORMES.

Cheyletes schneideri Oudemans.—A single female of this species was captured on a human head at Camborne, Cornwall, 5. viii. 45. The species has not previously been

recorded from the British Isles, although it is known in France and neighbouring continental countries. No doubt it has previously been confused with *C. eruditus* (Schrank), but it may be differentiated from that species by the fact that the femur of the palp is almost exactly as long as broad, and the claw of the palp carries three tubercles instead of the two which are found on the palpal claw of *C. eruditus*. In my specimen these tubercles are very small indeed, but are, nevertheless, quite conspicuous.

Trombidium holosericeum var. *septentrionalis*, var. nov.—In the south-western peninsula of England there exists a variety of this very common species, in which all the dorsal trichomes are the same. In effect, this means that there are no noticeably clavate ones, all being conical and rather slender. It appears to differ in no other respect whatever, and is to be found with the type form, although far less common than the latter. The range in size seems also to be identical.

Trombidium mediterraneum (Berlese).—This species was described by Berlese in 1912 and recorded as occurring in the Greek island of Corfu. In April, 1942, a mite, apparently agreeing in all respects except that of size, was taken in a house at Reskadinnick, Camborne, Cornwall. The two kinds of dorsal papillæ which seem so characteristic of this species were present, and are shown in fig. 19. Comparison of these with Berlese's figures will show the very close similarity between the two. The tarsal ratio was that given by Berlese, which would seem to make the matter of the identity of the specimen fairly certain, but the size was very much less than that given in the original description, being only $1,500\mu$ long as against $2,500\mu$ of the type. The fact that it has been taken in a house makes it very doubtful whether it could rightly be claimed as an indigenous species. Very likely it was imported into the country with currants or some such foodstuff.

Enemothrombium subrasum Berlese.—A specimen of this species was taken in grass in a garden at Reskadinnick. Camborne, Cornwall, on 13. v. 45. It differs somewhat from the description given by Berlese (1912) in some points. It is $1,800\mu$ (Berlese gives $1,900\mu$). The dorsal trichomes are on longer peduncles, and the fourth segment of the palpus has five spines on either side, instead of

three, and the anterior tarsus is not so markedly ovate-claviform. The papillæ agree well with Hull's (1918) description of them, and no doubt Berlese's figure (*loc. cit.*) was taken from a balsam-mounted specimen, in which case it is to be expected that they would tend to collapse or become otherwise distorted. Halbert (1915) has recorded the species from Ireland.

The British Species of Calyptostoma.

Hull (1918) records one species of this genus under the name *Smaris expalpis* (Herm.) and this, as Oudemans has shown (Krit. Hist. Overz. der Acarologie, series ii. p. 596), must now be known as *Calyptostoma velutinus* (O. F. Mull., 1776). Of this species I have myself taken several specimens in damp low lying habitats in the south of England, and it is probably widely distributed in the British Isles.

The genus *Calyptostoma* was proposed by Pickard-Cambridge (1875) for a species *C. hardyi* Pick.-Camb., which has either been overlooked by subsequent authors or taken to be a synonym of *C. velutinus*. The original figures of this species were reproduced by Murray (1876), and in 1913 Pickard-Cambridge himself added a further description and figures of the mouth-parts of his species, possibly because Murray (*loc. cit.*) had said: "It will be seen that the mouth in this species is a mere hole on the anterior part of the underside of a bladder-shaped body, and the parts in it seem, in Mr. Cambridge's figure, too indistinct to be depended upon." It seems to me doubtful whether these two species are, in fact, synonymous and only the examination of the type-specimen of *C. hardyi* could finally decide the question. In March of this year my friend, Mr. P. Brunet, of Keele College, Oxford, examined all the acarine material in the Pickard-Cambridge collection in the University Museum, Oxford, and he reports that there is no specimen of *C. hardyi* now preserved there. It seems most likely then, that the type is lost and comparison of undoubted specimens of *velutinus* with it will be impossible.

Accepting Oudemans' opinion that the *expalpis* of Hermann is the *velutinus* of Müller, it is necessary to decide, in the absence of types, whether *hardyi* is a good

although very nearly related species. Certainly, there are many similarities between the two species, but certain points of difference should be noted. Although the shape of the body is very variable, especially of the anterior part, depending on whether the mouth-parts are exerted or not, there is one important difference to be seen in that whilst *C. velutinus* is broadest at or about the shoulders, the figures of *C. hardyi* show it to be broadest at or posterior to the middle. In the latter species the length of the posterior pair of legs is shown to be equal to only two-thirds of the width of the body at its widest, whilst in *C. velutinus* they are equal to the greatest width. One other difference seems of even greater importance, namely that in 1913 Pickard-Cambridge figured the palpi (and other mouth-parts) of his species, of which he then had further specimens, and in spite of the detail with which he draws them he does not figure the very strong and long, outstanding lateral bristles, which are easily seen on the palpi of *C. velutinus*. All the specimens of *hardyi* seem to have come from higher altitudes, the type-specimens (Pick.-Camb., 1875) from the Cheviot Hills and at least the specimens figured in 1913 by the same author, came from Perthshire at a height of 3,500 feet; other specimens are recorded in the 1913 paper from Bere Wood, but these are not figured and may well have been the true *C. velutinus*. I, myself, have never taken specimens of *C. velutinus* at greater heights than 400 feet and in Cornwall, at least, no species of the genus seems to exist at greater heights, although on the high moors in the east of the county there are many suitable habitats in the Sphagnum pools. Hull (1918) has recorded *C. velutinus* (under the name of *Smaris expalpis* Herm.) from over 2,000 feet on the Cheviots, but here again the two species, if such they are, may have been confounded. Whatever the status of *hardyi* may be thought to be, there are good reasons for thinking that all specimens of *Calyptostoma* from higher altitudes, at least, should be carefully examined and compared, not only with undoubted specimens of *velutinus*, but with Pickard-Cambridge's figures of *C. hardyi*. For the present it seems best to retain this species, although still to be counted as an "uncertain" form; this course I have adopted in the key to the British species of *Calyptostoma* given below.

There is yet a third species of this genus which I have taken in Cornwall and which is new to the British list; this is *C. lynceum* (Berlese). I have identified my specimen—a female—from the drawings and notes given by Trägårdh (1931), and I have been unable to see the reference to the work of von Vitzhum (1929) which Trägårdh gives, as copies of it do not seem to be available in any English library.

My specimen shows the characteristic crassate front tarsi although, according to Trägårdh (*loc. cit.*), these are more conspicuous in the male than in the female; they are delineated from my specimen in fig. 20. The pseudo-stigmatic organ of the specimen is shown in fig. 21 and, as will be seen the sensory areas, are not so obviously separate as in the specimens from the Farøe Islands; the outer rim of each area is surrounded by thicker, darker chitin. The sensory area, too, is surrounded by a clearer circular space but not so pellucidly clear, especially posteriorly, as Trägårdh figures. I agree with him, however, that they seem to be moveable and can be withdrawn into a depression below the surface of the propodosoma. The sensilli appear to me to be very slightly thickened anteriorly. The genital and anal apertures I have figured in fig. 22, which shows their relative size and how they are situated in relation to the termination, around them, of the peculiar surface tracheæ of the genus. The genital suckers are placed further forward on my specimen than on those from the Farøes. The shutters of both apertures are surrounded by, and presumably attached to, a very thin, clear membrane, which in turn is surrounded by a slightly more chitinated area and the whole inset in the epidermis, the respiratory tubules terminating abruptly and truncately at the line of junction of the two.

It would seem, incidentally, that actually this is not the first record of the species from the British Isles, as Oudemans in his *Krit. Hist. Overz. der Acarol. series iii. Band C*, has the following entry:—

1813. *Acarus senoculata* Don. (Geo.) Account, etc., p. 55. (Appendix B to Headrick (Ja.) Agriculture County Angus)—Nom. nud.—Schotland.

This he identifies as *C. lynceum* (Berl.) If this identification is correct, and it certainly seems most probable,

then we have a record of this species from Scotland, dating from more than a hundred and thirty years ago and not another until the present time.

In the following key to the British species I have included *C. hardyi*, although as yet its status is doubtful; it is possible, however, that someone using the key, and having adequate material at their disposal, may some day be able to settle the matter authoritatively. It seems to me of some importance, however, that it should be retained, at least as an uncertain species, rather than be lost as a synonym of *C. velutinus*—a fate which the facts at present known, hardly warrant.

- | | |
|---|---|
| 1. Tarsi of the first pair of legs swollen and thicker, never more than twice as long as broad | <i>C. lynceum</i> (Berl.). |
| Tarsi of the first pair of legs more slender, at least two and a third times longer than broad and often more | 2. |
| 2. Body broadest at or about the shoulders; palpi with longer outstanding lateral setae | <i>C. velutinus</i> (Mull.). |
| Body broadest posterior to the middle; palpi apparently without longer lateral setae | [species incerta.
? <i>C. hardyi</i> (Pick.-Cmb.). |

Erythræus penninus (Hull).—This species was described by Hull in his 1918 paper, and has not been recorded since as far as I am aware. I have taken this species once more under heather at the Star Castle, St. Mary's, Isles of Scilly, on the 5.vi.45, and I can find no real difference between my specimens and the description given by Hull which is, however, short and is accompanied by but two small figures. The length is the same in both lots of specimens, viz., 1,300 μ . As in the type-specimens there are no spines on the third segment of the palp, but in the specimens from the Isles of Scilly this segment is very much broader and not so long (fig. 25). On the fourth segment, too, there are only two or three minute tubercles in place of spines, and the claw of the palp is rather more robust in the Scilly form than the type. The general form of the palp can be best made out from fig. 25. The length of the segments of the last legs differs somewhat from that given by Hull. The proportions he gives are:—110, 120, 240, 250, 290, 130, but those of my specimens are:—110, 115, 270, 280, 290 and 140. The dorsal trichomes, as Hull says, are minutely feathered, and

these featherings are closer together near the base of the trichome than at its apex (fig. 24). Hull neither describes nor figures the crista of the type, and to supplement his description I do so here. The general form of it can be seen from fig. 23, as also the comparative length of the four long, outstanding setae which lie immediately in front of the anterior sensory area. The type-specimens were taken from West Allendale, but on the evidence of the present record it is not an exclusively northern form in these islands.

Leptus killingtoni Turk.—A new *Leptus* larva was described by me (Turk, 1945) under this name but the figure in that paper, showing the dorsum, was reproduced in error, being actually a preliminary sketch on the back of the true figure which was intended to accompany the original description. The figure as given is correct, except that the dorsal trichomes are much less numerous than they are depicted and that they are, moreover, closely feathered and similar to those on the legs. I have now another record of this species: several specimens of the same larval form were taken from adults of *Anystis baccarum* (Linn.), which itself occurred in some numbers in a field at Feock, near Truro, Cornwall, in August 1944. This record has an added interest in that Dr. Killington, who first discovered this *Leptus* at Parkstone, Dorset, parasitising various species of Odonata, found *Anystis baccarum* (Linn.) to be very common in the neighbourhood, although as far as his observations go, he does not find it parasitising this host in that district.

Belaustium tardum (Halb.).—Specimens of this mite were taken on a shale path about 1,200 feet above sea-level at Brynmawr, Monmouthshire, Wales, 10.viii.45. These seem the first to be recorded since the original description of this species was published in 1915. This is a very distinct form, and Halbert's very good description makes identification both easy and certain. It is curious that the type-specimens were taken under stones on the sea shore at Bellacragher Bay, near Mullranny, and it would have seemed, but for the present record, that the species was an halophilous one; the occurrence of it so far above sea level makes that impossible.

Belaustium murorum (Herm.) and *Belaustium quisquiliarum* (Herm.).—Hull (1918) has recorded only the

second of these, and I can find no records from Britain of the first named species. In June, 1945, Mr. W. J. Richards sent to me a great number of specimens of *B. murorum* taken from the stone walls of a room at the Rothamstead Research Station at Harpenden, Herts. I have several other records of single specimens of this species, and it does not seem a very uncommon species in England, at least. The probability is that the two species have been variously recorded under the second of the two names and that many of the British records are hopelessly mixed. One thing is certain, however, and that is that both the species occur in these islands.

SARCOPTIFORMES.

Caloglyphus rodionovi Zachvatkine. - This name was proposed by Zachvatkine (1937) for the *T. mycophagus* of Schultze (1922-24) and Zacher (1927). In that paper the author revised the Diacotricha-Detricolæ of Oudemans and all the species of Caloglyphini and, in addition, showed that at least four separate species had hitherto been confused under the name of *Tyroglyphus mycophagus* Megnin.

Specimens that are presumably to be referred to this species, *C. rodionovi* Zach., occurred in very great numbers on a culture of *Musca domestica* (Linn.), grown on bran and oats at Mychett, Aldershot, Hants, and sent to me by Mr. P. M. Miles, 10.xi.45. This is the first record of the species for these islands.

The sexual dimorphism of the genus as now understood, is well seen by comparing fig. 26, the female, with fig. 27, the male. The female is 1,110 μ long, and the male 980 μ . According to Zachvatkine the species is easily identified by the fact that the anal suckers are on a level with the posterior end of the anal opening of the male (see fig. 28). The copulatory suckers on the tarsus of the 4th legs of the male are placed in the apical half of the segment as they are in these specimens (fig. 29). There are, however, despite the general agreement of these specimens with *C. rodionovi*, some curious discrepancies. The hairs of the male, as can be seen from fig. 27, are very long, longer than the width of the body, and this, according to Zachvatkine, is a diagnostic character of *C. berlessei* Michael which is the

T. mycophagus of Berlese (1883-1923) and of Kramer (1899). Moreover, there are falcate setæ on all tarsi, although on those of the 3rd and 4th legs they are single. On these specimens the pseudostigmatic setæ are exceptionally well developed, as can be seen from figs. 26 and 27.

At first I thought that this species might be the unnamed *Caloglyphus* form figured by S. Jary (1938) in his paper, giving an excellent account of Zachvatkino's work and

Figs. 26-29.

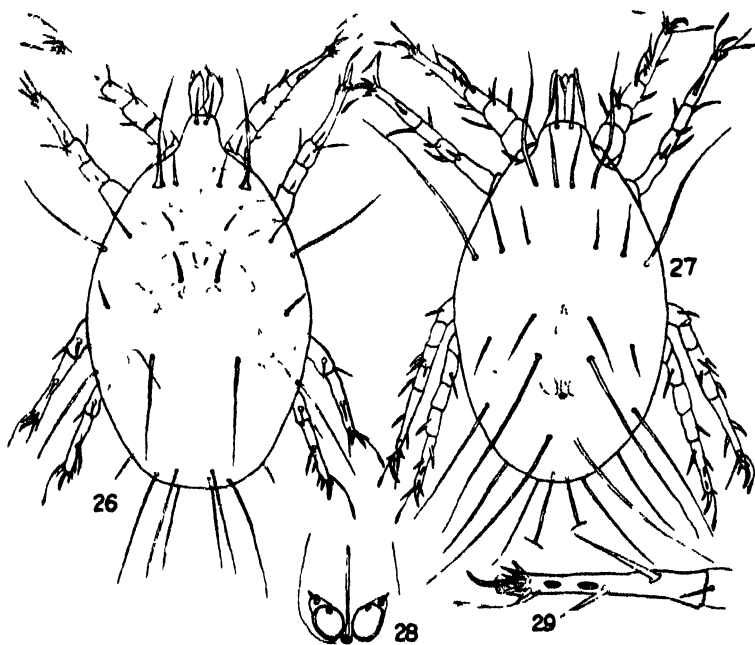


Fig. 26.—*Caloglyphus rodionovi* Zach. Female dorsal.

Fig. 27.—*Caloglyphus rodionovi* Zach. Male dorsal.

Fig. 28.—*Caloglyphus rodionovi* Zach. Anal aperture and anal suckers of the male.

Fig. 29.—*Caloglyphus rodionovi* Zach. Tarsus of 4th leg of male.

discussing two species of *Caloglyphini* found on mushrooms in England. There are, however, several differences: the internal scapular, the internal humeral and the second dorsal setæ of the male are all longer in the present species than on Jary's form, and the anal suckers are more posterior in position in his figure than in mine. Considerable

differences will be noticed too, in the placing and size of all the dorsal setæ of the females of both forms. If the identifications of each are correct then we have, so far recorded from Britain, *C. berlesei* Mich. (which species Jary suggests that his specimens belong to) and *C. rodionovi* Zach. The present identification is made more probable by the fact that Zachvatkine says that *C. rodionovi* is a synanthropic species found on foodstuffs, grain, flour, etc., and he adds that the hypopi occur on *Tenebrio molitor* and other grain-feeding insects. Although both the male and female adults and the nymphal form were found in the culture of the house fly, no hypopi were present.

At the same time as I received the above specimens, Mr. Miles sent me a tube of other Tyroglyphid mites which were swarming on a culture of *Calandra granaria* (L.) grown on wheat at Mychett, Aldershot, Hants. The acari from this source were *Tyroglyphus farinæ* (Linn.), *Chortoglyphus arcuatus* Troup. and a species of *Eberhardia* (*Cosmoglyphus*), to which at present I am unable to give a name and which I have reserved for further study. It appears to be nearly related to *E. rhizoglyphoides* Zach. in that the anal opening is very near to the edge of the opisthomosa, there are, however, one or two minor differences which make me hesitate to identify it as this species. The presence of these mites does not appear to affect the development of the cultured insects in any way, although Mr. Miles says that they are frequently present in such numbers as to completely cover the eyes of the flies and cause them to collide with one another and with other objects.

A Note on the Copulation of two Species of Feather Mite.

Various opportunities have occurred during the last two years for me to make fairly prolonged observations on the mating of *Megninia* (*Pandalura*) *strigis-oti* (Buch.) from the young of the Short-eared Owl and of *Protalges attenuatus* (Buch.) from the Barn Owl. The specimens of both species were taken from recently dead hosts and very large numbers (almost all the specimens seen, in fact) were observed to be *in copulo*. In my experience, I have not found anything like the same proportion of mating individuals in the various species of feather mites which I

have taken on other birds, and it seems to me probable that this is a characteristic of the epizoid acari of owls, and I am inclined to think that the lowering of the body temperature of the host, consequent on its death, induces mating of the mites.

In both species the heads of the male and the female nymph face in the same direction during copulation, the female nymph lying upon its back, venter uppermost. In this connection there seems to be two types of copulatory attitude in these mites as there is, according to Hirst (1917), in the Listrophoridae, for in that family he says that the two sexes face the same way in *Chirodiscoides*, but in opposite directions in *Schizocarpus*. Among the feather mites, the two sexes sometimes face in opposite directions during copulation as, for instance, in *Diplægidia columbae* (Buch.), and sometimes in the same direction, as in the two species from owls at present under discussion. The latter attitude is not just a later stage of the former and arising out of it, and the discrepancy between the two due to the period in the copulation at which any particular observation starts, for not only have I never seen couples of *D. columbae* in the second attitude, but I have frequently observed them to break coition, presumably on the completion of fertilisation, from the position in which they face in opposite directions.

The complete act of copulation I have only been able to observe in *M. strigis-oli*. In this species, prior to copulation, the male makes some desultory play with the large 3rd pair of legs, in front of and over the female nymph. The female then places the tip of the abdomen in juxtaposition to that of the male, who then appears to walk backwards over her a little way, she, at the same time, turning and fitting herself under the caudal lobes of the male. When this has been accomplished and the copulatory suckers of the male are firmly fixed, he walks about carrying the female nymph with him and only occasionally using the third pair of legs to grasp the nymph. Thus the function of these enlarged legs seems to be only partly for holding the female; it is probable from the pre-coital behaviour, that they serve as sexual stimulants, inducing in the nymph the necessary reflexes for her to pursue what is really an active role. Disengaging movements seem to be always the prerogative of

the male in this species. It may be mentioned here that in those species where the female nymph is very much larger than in the present one, it is this sex which walks around carrying the male.

In *Protalges attenuatus* the two pairs of hind legs seem to play a much more definite part in holding the female. Here the 4th pair of legs of the male just clasp the sides of the nymph, doing so tightly enough to cause slight indentations in the skin of the latter. The third pair of legs are wrapped around the dorsum of the nymph lower down the body, and both pairs seem to remain fixed until coition has finished. In the light of these observations it seems, therefore, that there are several patterns of mating behaviour in the feather mites, and that these may differ fairly considerably even in nearly related species.

A Note on the Seasonal Abundance and Variation of Chorioptes equi (Gerlach).

Specimens of this species were taken in Cornwall from the skin of a horse which had the base of the tail, the inside of the legs and the feet of the hind legs affected; they were collected in July 1945. It has long been known that there is a marked seasonal variation in the case of Sarcoptic Mange of the horse which very largely abates in the summer, the symptoms being much more acute in the winter time. The causes of this have not, I think, ever been fully investigated. Very few authors have mentioned this seasonal variation in the case of symbiotic or chorioptic mange and, indeed, I can only find one definite statement on the subject, namely that of Neveu-Lemaire (1912). He says: "La gale chorioptique évolue très lentement et se montre surtout pendant l'hiver; en été elle s'amende notablement." In the light of this I was interested to discover that all the specimens of the mite which I examined in this particular instance, and all of them taken at the height of the summer, were either larvæ or nymphs; no adult mite of either sex was present in all the thousands that were seen. As, undoubtedly, the most acute symptoms are caused by the ovigerous female, such a record would explain very easily why there should be a marked abatement in this mange during the summer months, June to September, supposing that in those

months the species is represented only by immature forms of the mite. I have not been fortunate enough to find other cases of this disease during summer, but the microscopic examination of a few such would go a long way to proving this hypothesis to be correct. I have, however, found many ovigerous females on the same horse in the month of December, when the symptoms were definitely more acute. Males were but infrequently found on this same animal in the same month.

Some British Records of Oribatei.

Nothrus sylvestris (Nic.).—All the specimens of this species which I have taken in Cornwall are didactyle, as mentioned by Warburton and Pearce (1905), and bear the two posterior hairs on fairly well marked papillæ. Seldom it seems are didactyle specimens seen in the more northern parts of Britain, and I have never seen really marked papillæ on specimens other than those from Cornwall.

Nothrus anauniensis Can. et Fanz.—Specimens agreeing well with this species, being tridactyle and with the abdomen posteriorly rounded, were taken in grass roots at Bell Lake, Camborne, 12.x.40. It seems, from a study of these specimens, that the character by which it may be most readily distinguished from the preceding species is that the posterior hairs are shorter than the width of the dorsum.

Belba gracilipes (Kulcz.).—Hull (1918) has the first record of this species from the British Isles, and it does not appear to have been taken since. I have one specimen, which seems quite typical, from Easternland, St. Just-in-Roseland, near Truro, Cornwall.

Damzelus maculosus (W. and P.).—I have specimens of this species taken in dead leaves, Tehidy, Camborne, 19.vi.40. It does not seem hitherto to have been met with by any author since Warburton and Pearce described it from examples taken in Cambridgeshire.

Oribatula lucasii (Nic.).—Two specimens of this uncommon species were taken from a wren's nest, Feock, Cornwall, in July 1941. They are tridactyle, with a very long sensillus, and the dorsum is shagreened and very dull.

Chamobates omisus (W. and P.).—Only Hull (1918) has recorded this since the original types were described. A specimen of this species was taken in the nest of a field

mouse at Feock, near Truro, Cornwall. Both Hull and the original authors say that it occurs in moss. This specimen differs a little from the type; it is rather different in shape and is 900μ long (Warburton and Pearce give 700μ). The apex of the anterior tectopedium is slightly crenulate and curved outwards in this specimen.

Notaspis hasticeps (Hull).—Specimens of this species were taken in the nest of the ant, *Acanthomyops* (*Donisthorpea*) *niger* (Linn.), at Bell Lake, Camborne, Cornwall, 13. viii. 45. It has not hitherto been recorded as occurring with ants.

Galumna longiplumus (Berl.).—This species was taken in considerable numbers in the same ants' nest and at the same time as the above. Berlese has described a form, *myrmophilus*, of this species, living with ants and distinguished by the fact that the line separating the 1. stogaster from the cephalothorax is evanescent. All these specimens, the only ones that I have ever seen, have this line very well marked indeed, and cannot therefore be the variety of Berlese, which since it has never been recorded from Britain, is most probably a true geographical subspecies.

Hoplodermia anomala (Berl.).—This rare species was taken in Douglas Fir litter in Bagley Wood, Oxford, 7. xi. 45, and sent to me by Mr. C. Fenton, of the Dept. of Forestry, Oxford University. In this species I find a fairly well-marked tooth on the single claw, which is neither mentioned nor figured by Michael or Berlese.

SUMMARY.

The following species are described as new to science, *Ichoronyssus orcadensis*, *Coproholaspis anglicus* and *Spinturnix omahonyi* as well as *Trombidium holosericeum* var. *septentrionalis* var. nov. The *Hæmogamasus arvicolarum* (Berl.) is restudied and redescribed besides being recorded for the first time from Britain. The following new species to the British acarine fauna are recorded: *Periglischrus rhinolophinus* (Koch), *Phaulocylliba romana* (G. and R. Can.), *Cheyletes schneideri* Oudms., *Trombidium mediterraneum* (Berl.), *Calypostoma lynceum* (Berl.), *Belaustium murorum* (Herm.) and *Caloglyphus rodionovi* Zach. The male of *Spinturnix plecotinus* (Koch) is described for the first time. An extended study is made of the British

species of the genera *Ichoronyssus*, *Spinturnix*, *Coproholaspis*, and *Calypstostoma*, together with dichotomic keys. The forms of *Pergamasus crassipes* var. *longicornis* Berl. are discussed and a new extreme variation described. Biological notes on the mating of feather mites and on the mites causing chorioptic mange in the horse are given. Notes are appended on other little known species of mites recorded from the British Isles.

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LXVIII.—*Notes on the Jurassic Flora of Yorkshire, 25-27.*
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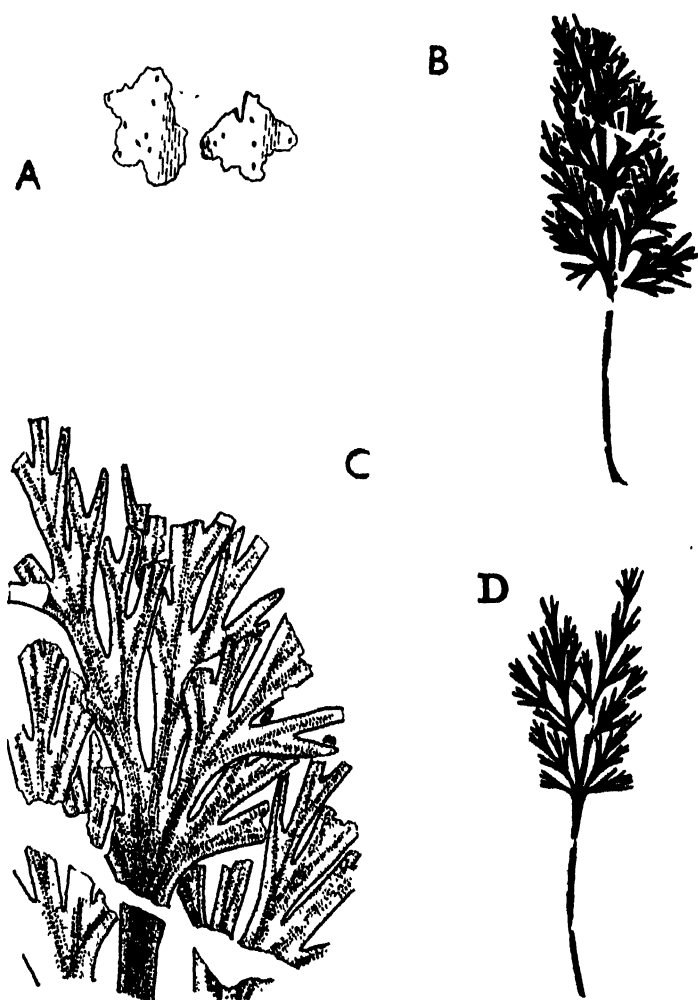
25. *Stenopteris nitida*, sp. n. (Figs. 1, 2.)

1900. *Ruffordia Gopperti* (non Dunker) Seward in part, p. 133. Reference to specimen 144 only.
1944. *Stenopteris williamsonis* (non Brongn.) Harris in part. Fig. 9 D and description of that specimen only. (Other figures and the rest of the description refer to true *S. williamsonis*.)

This beautiful little leaf is rare; it is represented on only two blocks, one in the York Museum, one in the Sedgwick Museum, Cambridge. Both blocks show nearly complete leaves which were originally well preserved, but have been damaged by a coat of varnish. There are fragments of a second leaf with the Cambridge one, which are partly immersed in rock and so shielded from the varnish. This yielded a good cuticle which supplemented the less good ones from the main Cambridge specimen and the bad ones from the York specimen. These preparations show that *S. nitida* is specifically distinct from *S. williamsonis*, though support its inclusion in *Stenopteris*.

The York specimen is localised as "Upper Shale Gristhorpe," but its matrix is not typical for the Gristhorpe Bed, though a similar matrix does occur there. The

Fig. 1.

*Stenopteris nitida.*

A two fragments of lower cuticle showing distribution and orientation of stomata in relation to the vein (ruled with broken lines), specimen, 144 $\times 20$. B, specimen 144 in Leckenby collection, $\times 1$. The apices of most of the segments are broken and thus appear blunt. C, upper part of the specimen shown in B, $\times 4$. D, type-specimen (York Museum), refigured (as in Harris, 1944).

Cambridge one is only labelled Lower Oolite Yorkshire, but its matrix is just like that of the Gristhorpe Bed. It is thus not unlikely that the specimens were obtained from the Gristhorpe Bed of the Middle Estuarine series. The York specimen, as the first figured, is made the Type.

The Cambridge specimen has two labels giving determinations. The earlier, in Nathorst's writing, says: "Possibly the young leaf of *Sphenopteris Williamsonis*, or perhaps the same as *Sphenopt. Jugleri* Leck. A.N.," and the second due to Seward gives the name *Ruffordia gapperti*.

I am indebted to Messrs. R. Wagstaffe and A. G. Brighton for lending me the specimens.

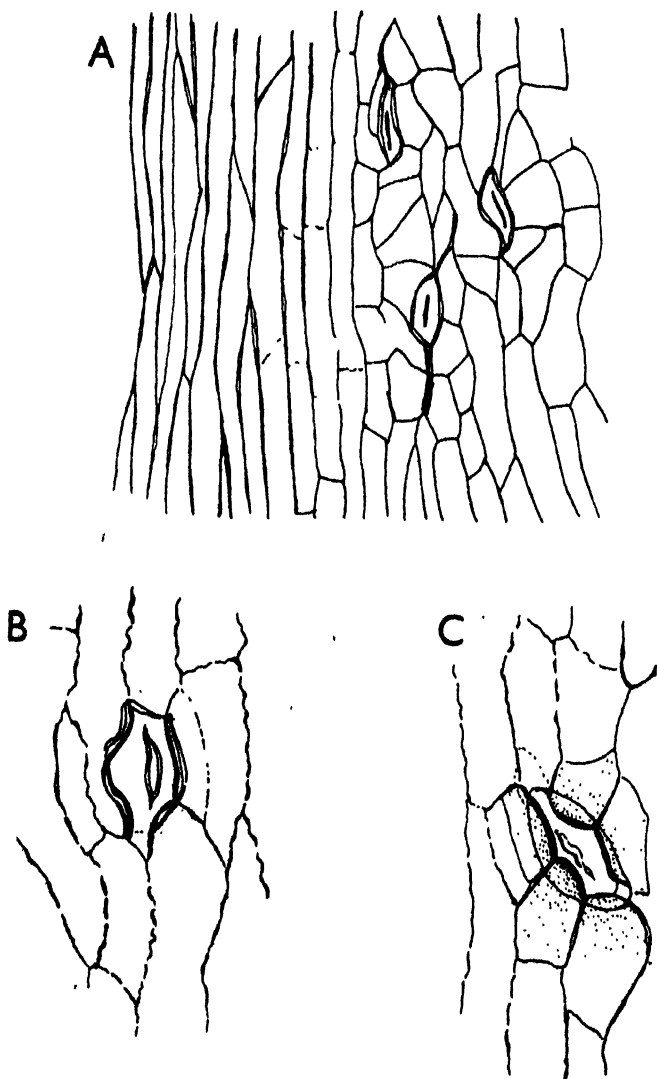
Diagnosis.—Leaf small, petiole slender, about 3 cm. long; lamina as a whole oval, about 3–4 cm. long, 2 cm. wide. Rachis at base of lamina simple or once forked. Leaf branched pinnately two to three times. Primary branches opposite, secondary branches usually alternate, ultimate branches almost dichotomous, apices acute. Rachis near base of lamina about 1.5 mm. broad, main branches about 1 mm. broad, gradually narrowing to ultimate pointed branches 2 mm. long, 0.5 mm. broad. Branches crowded, overlapping to a considerable extent. Lowest secondary branch on catadromic side (facing leaf base) arising at the very base of the primary branch, or even on the main rachis. Petiole and main rachis largely composed of the vascular tissues, but with a slight wing of lamina, vascular strand narrowing above and lamina becoming broader in main branches and continuing without interruption into the final branches, where there is only a slender mid-vein which extends to the apex of the branch. Substance of lamina fairly thick, showing no characteristic mesophyll structure.

Cuticle of both sides thin (barely 1μ) but fairly tough; stomata confined to underside, as far as is known.

Upper cuticle showing elongated cells with almost straight, moderately conspicuous walls. Cells along veins narrowed. Trichomes absent.

Lower cuticle showing stomata at a rather low concentration, about 24 per sq. mm.; stomata absent near veins. Cells along veins narrow, longitudinal walls strongly marked, end walls scarcely visible; cells between veins varied, usually about two to three times as

Fig. 2.



Stenopteris nitida.

Cuticle from specimen 144, Leckenby collection. A, lower cuticle showing midrib (on the left) and three stomata, $\times 200$. B, exposed stoma, $\times 400$. C, rather more protected stoma, $\times 400$.

long as broad and sometimes (especially near stomata) isodiametric. Walls rather finely marked but usually distinct, almost straight, but sometimes appearing discontinuous or with very slight sinuous folds. Cell surface on both sides obscurely and evenly mottled with small thickenings or pits.

Stomata longitudinally orientated, irregularly spaced and not forming definite rows. Guard-cells thinly cutinised except round aperture, only slightly sunken, most of surface usually exposed. Subsidiary cells forming a very indefinite ring, but usually small; sometimes thicker than rest of cuticle. Lateral subsidiary cells usually overhanging margins of guard-cells, but poles of guard-cells probably at the surface.

Petiole slightly more thickly cutinised; cells nearly all elongated, but with a few short ones near stomata. Cell surface mottled, or with fine parallel ridges running in any direction. Stomata less frequent and more overhanging by subsidiary cells than on the lamina.

Discussion and comparison.—The two main specimens are extremely similar leaves, differing in that one forks at the base of the lamina, but in other respects the branching is similar. The figured cuticles were obtained from a third leaf, of which a few branches only occur at the edge of No. 144. These branches match those of the main specimen exactly, and their cuticle is similar but better preserved.

S. nitida differs from *S. williamsonis* in the smaller size of its leaf, relatively longer petiole, finer branches and in the lack of hairs and papillæ on the epidermal cells. The specimen now selected as Type was originally included by me (Harris, 1944) in *S. williamsonis* as an unusually small leaf (though doubt was expressed). The Cambridge specimen, by providing a cuticle, has now convinced me that it is distinct. In *S. williamsonis* nearly every cell of every cuticle preparation shows a papilla or small hair, and these are to be seen even without maceration along the sides of the lamina.

In *S. nitida* no such papillæ are to be seen before or after maceration.

S. nitida is distinguished from all other species of *Stenopteris* by the small size of the leaf and the fine, close branching.

The Cambridge specimen, Leckenby Collection 144, had been confused with the specimen 158, now called *Sphenopteris metzgerioides* (see note 26) under the name *Ruffordia gæpperti*. *S. nitida* looks very different from *Ruffordia*, having a long petiole, but the dimensions of its branches are similar to those of *Sphenopteris metzgerioides* and that leaf does indeed rather resemble *Ruffordia*. *S. nitida* shows strongly developed catadromic branching, that is the first secondary branch is often at the base of the primary branch or even on the main rachis, while in *S. metzgerioides* it is, as usual, well out on the primary branch. Another difference is that the branch apex is acute in *Stenopteris nitida*, rounded in *Sphenopteris metzgerioides*. The most striking difference is in the lamina which, in *S. metzgerioides*, is composed of a single clearly shown layer of cells, while in *S. nitida* it is of many cell layers and no one layer is distinct. *S. metzgerioides* appears to have no cuticle.

The specimen represented in Phillips' figure (1875, Lign. 9) as *Baiera microphylla* looks rather like *S. nitida*. I have, however, re-examined Phillips' specimen (Leckenby Coll. 389 in the Sedgwick Museum) and find its cuticle distinct from that of *S. nitida*; and in agreement with Seward, 1919, p. 65, I consider it should be called *Czekanowskia microphylla* (Phillips).

The specific name *nitida* refers to the neat appearance of this leaf.

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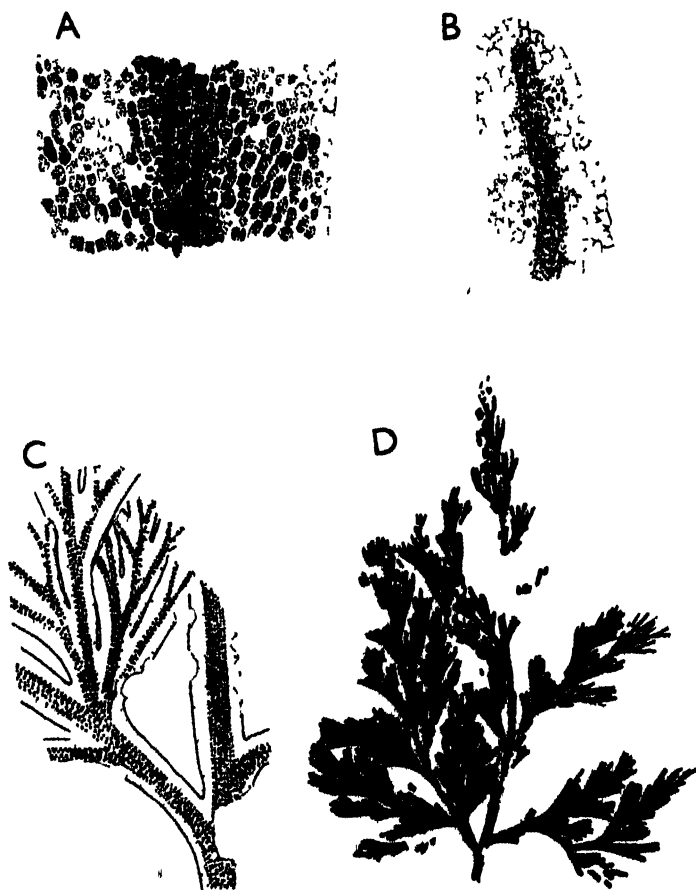
26. *Sphenopteris metzgerioides*, sp. n. (Fig. 3.)

1864. *Sphenopteris Jugleri* (non Ett.) Leckenby, p. 79. (Brief reference to present specimen.)
 1875. *Sphenopteris Jugleri* (non Ett.) Phillips, p. 218, Lign. 40. (Rough figure of present specimen.)
 1894. *Ruffordia Gæpperti* (non Dunker) Seward in part, pp. 77, 78. (Reference to present specimen only.)
 1900. *Ruffordia Gæpperti* (non Dunker) Seward, p. 133 in part. (Reference to present specimen only.)

The specimen described here is the only one of its kind known. It is No. 158 in the Leckenby Collection in the

Sedgwick Museum, Cambridge, and bears the labels "*Sphenopteris Jugleri* Ett." and a later one naming it *Ruffordia Gæpperti*. The locality label is "Lower Shale, Scarborough," which was applied so indiscriminately as to

Fig. 3.



Sphenopteris metzgerioides, Type-specimen.

A, part of a leaf segment in which the cells are represented by their dark contents, $\times 60$. B, apex of leaf segment, cell walls preserved, $\times 40$. C, part of main rachis and base of a pinna, showing the veins, $\times 4$. D, whole specimen, $\times 1$.

be nearly meaningless. The matrix looks like that of the Gristhorpe Bed, which would make it Middle Estuarine. It is associated with *Nilssoniopteris vittata*, one of the

commonest fossils in the Gristhorpe Bed. Phillips and Fox-Strangways, however, attribute it to the Lower Estuarine of 'Staintondale.' I have not seen any matrix like this in the Haiburn and Staintondale cliffs.

The specimen, though of most delicate texture, is remarkably perfect and must have been beautiful at first, though it has been damaged by a coat of varnish.

Diagnosis.—Leaf (in part known) of roughly triangular shape, about 7 cm. long, 7 cm. broad, tripinnate. Rachis slender in upper part, not channelled. Primary branches nearly opposite, secondary and tertiary branching alternate, giving place to nearly equal dichotomy. Primary, secondary and tertiary rachises flanked by a continuous lamina; lamina widest (about 0.5 mm.) on primary rachis, growing gradually narrower on smaller branches, about 0.15 mm. wide on terminal branchlets. Apices rounded, vein ending just before the apex. Lamina delicate, everywhere composed of a single layer of cells about 50μ long, 40μ broad, but midrib containing a number of narrow cells in addition to an epidermis of cells like those of the lamina. No cuticle present.

Discussion.—The single layer of cells of the lamina can be readily seen almost everywhere when the specimen is immersed in oil. The cells usually appear as dark polygons, separated by clear lines (fig. 3 A); but occasionally are represented by the dark walls (fig. 3 B); transition from the one to the other type of preservation occurs frequently. Nowhere was there any suggestion of a second layer of cells in the lamina.

The branches of the leaf are crowded and evidently overlapped to a considerable extent, with a result that a good many branchlets are hidden or broken off. This causes some of the secondary branch systems to appear as though one-sided. The branching is noticeably irregular, in one place appearing anadromic in another catadromic.

S. metzgerioides is interesting in several respects. Its differentiation from *Ruffordia goepperti* removes one of the very few species which were supposed to exist in common between the Middle Jurassic and Wealden floras. The leaf is comparable in form and structure with the modern species of *Hymenophyllum*, where the lamina is also one cell thick, but there is no other evidence to point to the

Hymenophyllaceæ. Whatever its family, it is to be regarded as a "filmy-fern"; such ferns being characteristic of climates with very humid air. Its occurrence is equivocal, its presence suggests a humid climate, but its extreme rarity suggests that such a climate was far from widespread. There is, however, no evidence that it had drifted from afar; its extreme delicacy is against this. The flora of the Gristhorpe Bed as a whole is indeed regarded as having been deposited very close to the place where the plants grew.

Comparison.—*Sphenopteris metzgerioides* has already been distinguished from *Stenopteris nitida*.

It undoubtedly resembles *Ruffordia gæpperti* very closely in general appearance, and it is impossible to make out any difference between the present specimen and some of Seward's figures. Comparison of the specimens with a microscope distinguishes them easily. In *Ruffordia gæpperti* (specimens in the Rufford Collection from the English Wealden) the lamina is much more than one cell thick, and the apices of the lobes are acute, acuminate or mucronate, not rounded. Even in a specimen of *Ruffordia* where the lamina was preserved as a thin brown film, there was no suggestion of a single layer of cells, but in places several superimposed layers were seen.

There is no other fossil known to me which could be confused with *S. metzgerioides*, but a good many of the specimens described under *Ruffordia gæpperti* from various regions besides the English Wealden, resemble it to some extent.

The specific name *metzgerioides* refers to the resemblance in texture of the lamina to that of various kinds of *Metzgeria* (Hepaticæ).

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27. *Pseudoctenis herriesi*, sp. n. (Figs. 4, 5, 6.)

This species is represented by the following material :—

(1) The type-specimen in the Herries Collection, York Museum. This is unlocalised, but is associated with the characteristic Lower Estuarine species *Phyllophyllum pectinoideum*. The matrix agrees with that of material (2).

(2) Specimens collected by me in 1945 from a block of Lower Estuarine shale on the beach at "Yellow Sands" or "Long Bight," just south of Whitby (Long. $0^{\circ} 36' W.$). The block appears to have fallen from near the base of cliff, just above the Dogger. This is at the classic Whitby locality.

(3) Cuticle fragments agreeing with *P. herriesi* obtained by macerating a sandstone from just above the Dogger, at Saltwick (by the waterfall). This rock is far below the Eller Beck Bed.

(4) A cuticle fragment (V. 26914) from the Middle region of the Lower Estuarine, Foot of Staintondale Cliffs; just south of the *Equisetites columnare* bed (at about Lat. $54^{\circ} 21' 45''$). This also is below the Eller Beck Bed.

I am indebted to Mr. R. Wagstaffe for lending me the type-specimen.

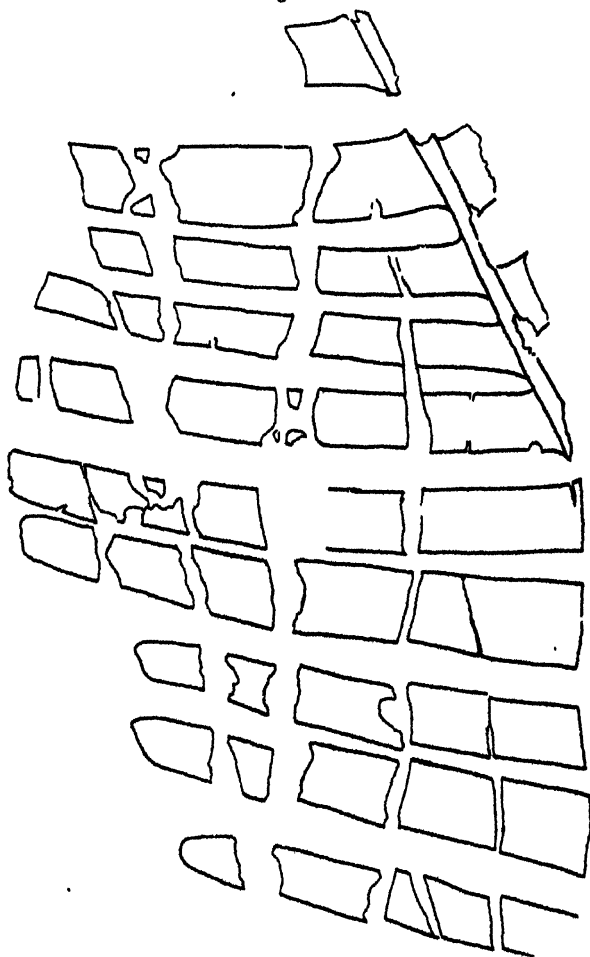
Diagnosis.—Leaf very large, perhaps over 1 m. in length. Rachis about 8 mm. wide at the base. In lower part of leaf pinnæ short (about 12 mm. long) and narrow (1-3 mm. wide); in middle region of leaf, becoming about 10 cm. long and 6-12 mm. wide; upper part of leaf not known.

In lower part of leaf pinnæ arising at 90° to the rachis, tapering to an acute point. In middle region of leaf, pinnæ arising at 60° - 80° to the rachis, either parallel-sided from near the base or tapering very slightly; apex obliquely truncate or slightly contracted. Width of adjacent pinnæ by no means uniform, but gaps between pinnæ more uniform, about equal to a pinna width in some leaves, rather less in others. In both middle and lower regions, pinna base always expanded, upper margin rising slightly along the rachis, lower margin usually more considerably decurrent and often meeting the lamina of the next pinna.

Veins rather distinct, running from base to apex of pinna without branching or anastomosing or ending in the margins; in middle of leaf, concentration typically

about 32 per cm. near the rachis and 48 per cm. near the apex in a tapering pinna; concentration about

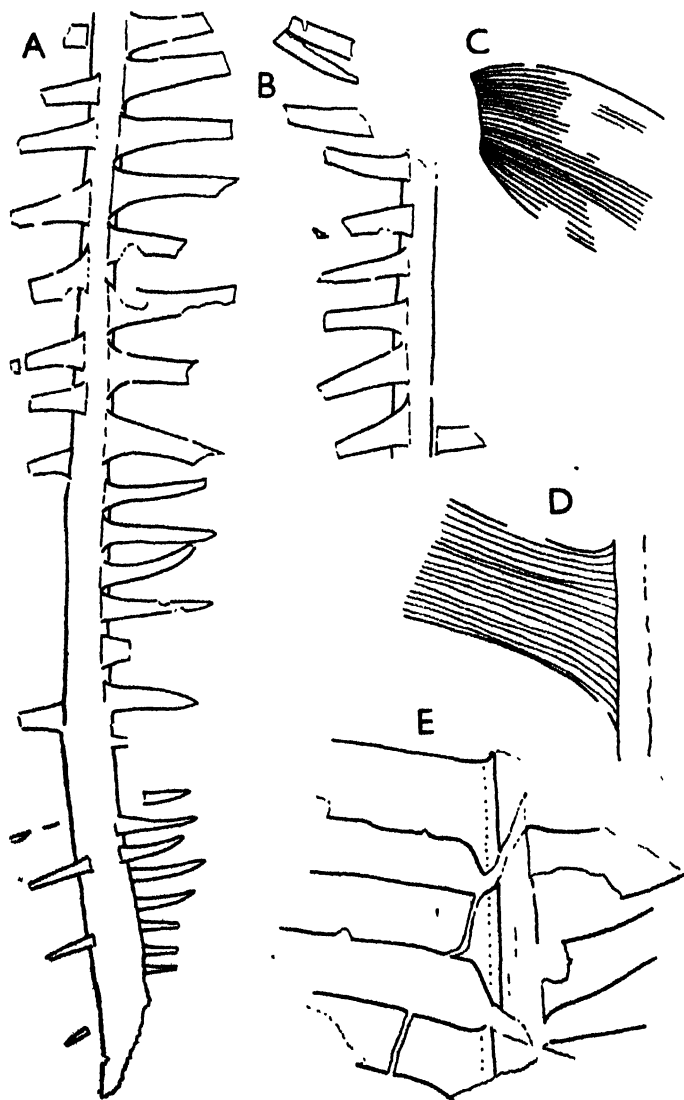
Fig. 4.



Pseudoclenis herriesi. Type-specimen, York Museum.
The three lowest pinnae have been omitted. $\times 1$.

25 per cm. in largest pinna, but up to 50 per cm. in small pinnae at base of leaf. No ducts or resin masses occurring between veins.

Fig. 5.



Pseudocotyle herriesi.

- A, basal part of leaf (continued in B), V. 26909 (drawn from part and counterpart), $\times 1$. C, apex of pinna of type-specimen showing the veins, $\times 3$. D, base of pinna of the type-specimen showing the veins, $\times 3$. E, part of a specimen showing expanded bases of pinnae (this leaf fragment is about 20 cm. long), V. 26910, $\times 1$.

Surface sculpture of lamina consisting of broad ridges with elongated, bulging cells along the veins separated by furrows of equal or slightly greater width between the veins; hairs not apparent. Rachis hairless, showing obscure longitudinal ridges.

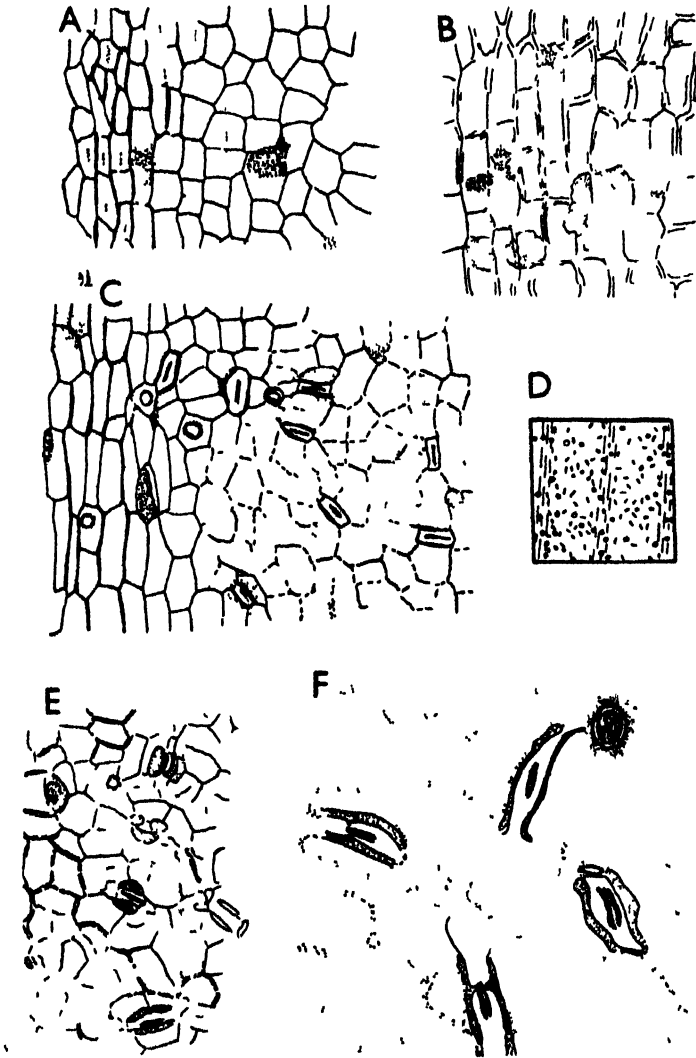
Cuticles of medium thickness, upper about 2μ , lower about 1μ (measured in folds). Upper cuticle showing neither hairs nor stomata. Veins rather obscurely marked by narrower cells with thickened longitudinal walls. Cells rectangular or polygonal, often forming obscure longitudinal rows. Walls obscurely marked, sometimes appearing as a broad band, sometimes as a clear line with or without the broad band. Sculpture obscure, but cells along veins sometimes showing one or more longitudinal striations. No papilla present. Traces of elongated hypodermal cells often present; scattered cells occupied by dark material apparently belonging to the cell contents.

Lower cuticle showing fairly conspicuous bands of elongated cells along the veins; stomata confined to broad strips between the veins, but stomatal strips ill-defined. Cells between the veins polygonal; outlines usually very obscurely shown by broad slightly thicker bands. Sides of cells straight, surface not markedly sculptured; no papilla present. Stomata fairly numerous, scattered, irregularly orientated. Guard-cells only slightly sunken, forming a very shallow rectangular pit. Subsidiary cells very irregular, not at all specialised except for a thickened margin next the guard-cells. Guard-cells thickened round the aperture, but the rest of the exposed surface is usually thin. Occasional cells occupied by dark matter as on the upper surface. Encircling cells absent.

Trichome-bases rather numerous, both on and between veins; consisting of a normal sized or rather small cell with a circular, thickened scar.

Discussion.—The type-specimen, and those collected from Long Bight are all fair-sized fragments. All yielded cuticles which showed the characters mentioned in the diagnosis, particularly the ill-defined cell outlines and conspicuous dark patches on the upper cuticle, but their appearance was poor because the coarse matrix has damaged them. Most of the drawings of the cuticle were, therefore, made from the better preserved fragments

Fig. 6.



Pseudoctenus herriasi.

A, upper cuticle, V. 26913, $\times 200$. B, upper cuticle of type-specimen. cell outlines appear broad. C, lower cuticle, V. 26912, $\times 200$. D, 1 sq. mm. of lower cuticle showing three veins; stomatal apertures shown by short black lines, trichomes by rings, V. 26912. E, lower cuticle of type-specimen, $\times 200$. F, lower cuticle, V. 26912, $\times 400$.

from Saltwick. These are small pieces of lamina obtained by macerating shale in bulk. They merely show the margin and parallel veins of a pinna, but were identified because of their agreement in microscopic characters with the cuticles of the large specimens.

It should be pointed out that in the fragment of cuticle shown in fig. 6 D a large proportion of the stomata are nearly longitudinal. This seems to have no significance as in other preparations an equally large proportion are nearly transverse.

Pseudecten *herriesi* has stomata which show that it belongs to the group of leaves called the *Ctenis*-series, probably allies of the true Cycads. It seems best placed in *Pseudecten*, although the status of that genus is vague.

Pseudecten was founded by Seward in 1911 as a transitional genus for a leaf having the non-anastomosing veins of a *Zamites* and the decurrent pinna margin of a *Ctenis*. It was not then known that these two genera have such different stomata that no transitional genus is to be expected, and there is still no information about the cuticle of the type-species, *P. eathiensis*.

Seward called attention to the occurrence of a few vein anastomoses in *Pseudecten*; it is obvious that if these are general they would blur the distinction from *Ctenis*.

However, they may be merely rare abnormal fusions such as are to be found in many fossil gymnosperms as well as in recent and fossil ferns in which free veins are the rule. This character has been very largely dropped by later authors.

Several additional species have been described since 1911 which considerably extend the range of form in the genus; thus *P. ensiformis* has lanceolate segments and *P. balli* (Feistm.) broad, rectangular ones (see Seward, 1917, for references.) The cuticle of one species, *P. spectabilis*, has been described in some detail (Harris, 1932) and two others (*P. lanei* Thomas and *P. depressa*) are partly known (Harris, 1932). These three have stomata essentially like the Cycads and the present leaf. The cuticle of an undetermined Wealden species resembling *P. lanei* has been described in detail (Carpentier, 1938).

Another leaf of similar form, and with stomata of the same general type, has been described as *Pseudopterophyllum cteniforme* (Nath.) Florin, 1933. It looks rather like certain leaves already included in *Pseudecten*,

particularly *P. brevipennis* Oishi. The relation of *Pseudopterophyllum* to *Pseudoctenis* has been neither discussed nor defined; and if a comprehensive definition of *Pseudoctenis* were given it might become a synonym. Its stomata are more protected than in the present species, but probably not more than in *P. lanei*, and, in any case, a similar range of stomata is seen among species still included in *Ctenis*. Other features, such as the papillate epidermal cells could be regarded as of generic, or else as of specific value. This whole assemblage of species evidently needs critical revision.

P. herriesi differs from most species of *Pseudoctenis* in the shape of its pinnæ, which are not at all contracted near the rachis. In the type-species, *P. eathiensis*, and in several others (see Seward, 1917), they are distinctly contracted. More recent descriptions of *Pseudoctenis* leaves with contracted pinnæ include *P. eathiensis* by Walkom, 1917, 1924; *P. lanei* by Oishi, 1940; and *P. brevipennis* Oishi, 1940. *P. lanei* Thomas, the only other species occurring in the Yorkshire flora, also differs in its pointed leaf segments, occasionally forked and less crowded veins, and its more protected stomata.

Among the species with uncontracted pinnæ are *P. balli* (Feistmantel) (see Seward, 1917), and *P. spectabilis* Harris, 1932, which both have very broad pinnæ and forked veins. The least different is *P. depressa* Harris, 1932, a little-known species from the basal Lias of Greenland. Even in *P. depressa*, however, the pinnæ are twice as broad and the veins, though simple, are much less crowded.

P. herriesi is thus a sharply distinguished species, and it appears to be a characteristic Lower Estuarine fossil.

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LXIX.—*African Colletid Bees.*

By T. D. A. COCKERELL.

Colletes inornatus, sp. n.

♂.—Length about 11.5 mm.; black, including legs and antennæ; face broad; head with abundant long dull whitish hair, the hair on cheeks extremely long; upper part of clypeus dull, excessively closely and minutely punctured, lower part less closely punctured, glistening; malar space extremely short; apical half of mandibles reddish; antennæ long, the sutures between the joints deeply impressed; mesonotum and scutellum shining, finely punctured, the mesonotum polished anteriorly, but dull on disc; hair of thorax long, very long, abundant and slightly reddish on hind margin of scutellum and sides of metathorax; no black hair on thorax; tegulæ black; wings faintly dusky; nervures black, stigma reddish, very small; second submarginal cell very broad, receiving recurrent nervure in middle; legs with long pale hair; abdomen with very long pale hair on first tergite; the following tergites with thin black hair on disc, but the depressed pallid margins with thin pale hair, not forming evident bands; sternites with pale, slightly reddish hair; the hair on inner side of hind basitarsi is red.

Cape Province: Rapenburg, Cape Flats, Oct. 1-14, 1920 (*R. E. Turner*).

By the short malar space this resembles *C. levisi* Ckll., from Natal and S. Rhodesia, but that has broad conspicuous abdominal bands.

Colletes opacigenalis Friese.

S.W. Africa: Okahandja, Dec. 1920 and Jan. 1928, 4 ♂ (*R. E. Turner*).

These differ from a cotype received from Friese by having the hair of scutellum distinctly reddish. As Friese remarks, this has the aspect of a desert bee.

Six males are from Matjesfontein, Nov. 1928 (*Turner*). With these is a single female, which seems to belong here, but the malar space is much shorter. It is about the same size, and has the same sort of wings. The abdomen is less shining.

Colletes montis, sp. n.

♂.—Length about 9 mm.; black, with the tarsi and hind tibiæ dusky reddish; antennæ and mandibles black, but tegulæ ferruginous; the abundant hair of face and front distinctly flavescent, of cheeks white; malar space short but not linear, about twice as broad as long; mesonotum and scutellum dull, shining along front margin; mesonotum and scutellum with fox-red hair, not mixed with black; wings hyaline, faintly dusky, nervures black; stigma small, reddish, with a broad dark margin; second cubital cell receiving first recurrent nervure very slightly beyond middle; abdomen shining, with five dull fulvescent bands.

This is very like *C. rufitarsis* Friese (compared with a specimen received from Friese), but that has a broader face, with dull white (not fulvescent) hair, hair of thorax above not so red, hind tibiæ much darker, and a larger malar space. It must be said, however, that this *C. rufitarsis* (from Mulango) does not agree very well with Friese's account. Also, the specimen from Mulango in the American Museum has the stigma dark, and the hair of face and front all fulvous. In my key to the Friese species in the American Museum this runs better to *C. abissinicus* Friese, but I have a specimen of that (from Harrar) from Friese, and it is quite distinct by the abdominal bands and other characters.

Mt. Ruwenzori, Belgian Congo, 0° 30' N., 29° 50' E., 1400 m.; June 5, 1914 (*J. Bequaert*).

I thought this should be the male of *C. ruwenzoricus* Ckll., described from a female taken at the same time and place, but the hair of the thorax is not mixed with black, the mesonotum does not have a shining discal area, the nervures are black, so that I hesitate to refer it to the described species. Among the South African species, it appears to be nearest to *C. marlayi* Ckll.

Colletes hirsutissimus, sp. n.

♂.—Length 11.5 mm.; black, including antennæ, legs, tegulæ and mandibles; malar space rather short, broader than long; face broad; face and front densely covered with long white hair; cheeks and front legs with long white hair; hair of thorax very long and abundant rather dull white, but posterior, and first tergite of abdo-

men, pale ferruginous ; the long red hair on scutellum is just like that on first tergite ; tergites beyond the first with long black hair ; some of the hair at sides pale, and vertex with pale hair ; hind margins of tergites dark reddish, but no abdominal bands ; wings clear hyaline, stigma and nervures dark brown ; stigma small ; second submarginal cell much widened below, receiving recurrent nervure at middle.

Cape Town : Lion's Head, Aug. 1920 (*R. E. Turner*).

Rather like *C. inornatus*, but easily distinguished by the abundant long hair of abdomen and the malar space. *C. capensis* Cameron, has the hair of mesothorax long and white, of the scutellum orange red, but the second submarginal cell receives the recurrent nervure beyond middle, and the malar space is much longer than wide (type examined).

Colletes testaceipes Friese.

Cape Province : Matjesfontein, Oct. 6-15, 1928 (*R. E. Turner*), 1 ♀.

Colletes albohirtus, sp. n.

♂. - Length nearly 12 mm. ; black, including mandibles, antennæ and legs, except that the tarsi are dusky reddish ; tegulæ very dark brown, almost black ; head broad, but orbits somewhat converging below ; malar space well developed, but much broader than long ; face densely covered with long pure white hair ; head and thorax with abundant white hair, but on the scutellum it is pale ferruginous ; mesonotum dull ; wings hyaline, with brown nervures, stigma small, dark brown ; abdomen minutely punctured, the basal half dullish, the apical half more shining ; five rather narrow white hair-bands ; venter with four very distinct bands.

Cape Province : Matjesfontein, Nov. 14-27, 1928 (*R. E. Turner*).

This might be taken for *C. martini* Ckll., but it is easily distinguished by the abdomen, which in *C. martini* has the first two tergites, before the bands, with pale hair, in striking contrast with the bare shining surfaces of those beyond ; also, *C. martini* has a shorter, broader, face.

Colletes denudatus, sp. n.

♂.—Length about 12.5 mm.; black, including mandibles, antennæ, legs and tegulæ, the latter brownish externally; face broad, it and cheeks densely covered with long pure white hair; malar space well developed, but much broader than long; hair of thorax mainly white, but pale reddish on scutellum; parts of mesonotum highly polished; wings hyaline, stigma and nervures dusky reddish; second submarginal cell very broad, its sides almost parallel; hind tibiæ with a transverse brush of pure white hair at end; abdomen dullish, the brownish hind margins of second and following segments shining; first tergite with long hair, but no hair bands, although in lateral view the abdomen appears quite hairy, the hair on the discs of the first two tergites white, on the following ones pale brownish; venter with white hair.

Cape Province: Matjesfontein, Oct. 6–15, 1928 (*R. E. Turner*).

Related to *C. inornatus* Ckll., but easily distinguished by the pure white hair of head and most of thorax, and the clear hyaline wings.

Colletes cardiurus, sp. n.

♀.—Length about 9 mm.; black, including antennæ, mandibles, tegulæ and legs; hair of head and thorax scanty, white, pale reddish and more abundant on scutellum; face very broad; malar space nearly square; clypeus prominent, dullish, the upper part in middle highly polished; supraclypeal area shining; mesonotum shining on disc, highly polished posteriorly, scutellum shining anteriorly; wings dusky, nervures and stigma dark brown; sides of second submarginal cell strongly converging above; abdomen broad, cordiform shining, not distinctly banded, but weak white hair-bands at sides of second to fourth tergites; long hair at sides of apical part.

Cape Province: Matjesfontein, Oct. 6–15, 1928 (*R. E. Turner*).

Among the species without abdominal bands, it is known by the small size and the heart-shaped abdomen.

Colletes aureocinctus, sp. n.

♀.—Length about 12.5 mm.; robust, black, including mandibles, antennæ and legs, tegulæ small, dark reddish; face broad, clypeus dull, without a median groove, supra-clypeal area shining; malar space large, subquadrate; hair of head scanty, dull white; of thorax greyish white, a little black on scutellum and hind part of mesonotum, easily overlooked; mesonotum mainly dull, but posteriorly polished and strongly punctured; scutellum polished anteriorly, posteriorly dull; wings rather short, faintly dusky; stigma small and dark; nervures dark; first recurrent nervure joining second submarginal cell slightly beyond middle; hind tibiæ and outer side of basitarsi densely covered with greyish-white hair; abdomen shining, with five broad bands of orange tomentum.

Cape Province: Matjesfontein, Oct. 6–15, 1928 (*R. E. Turner*). 4 ♀.

This could be taken for *C. antecessus* Ckll., but it is easily separated by the larger malar space and the black legs.

Colletes reginæ, sp. n.

♀.—Length about 12 mm.; black, including antennæ, mandibles and legs, except that the hind tarsi are obscurely reddish; malar space very short, clypeus densely punctured with a broad smooth channel in middle (a unique feature!); supra-clypeal area densely punctured, not shining; sides of front and face densely covered with white hair; hair of cheeks and sides of thorax white, on mesonotum pale greyish, on scutellum red, no dark hairs intermixed; tegulæ red; wings dusky; stigma dusky red; third submarginal cell short, higher than broad; disc of mesonotum with very large, well separated punctures; abdomen dullish, the hind margins of the tergites pallid and shining; abdominal hair bands broad, whitish, but mostly abraded in the specimen studied; venter shining, first sternite hairy, second with an interrupted hair band.

Cape Province: Queenstown, 3500 ft., Jan. 16 to Feb. 10, 1923 (*R. E. Turner*).

In Friese's table it runs near *C. ruficollis* Friese, which has red mandibles, and the flagellum red beneath. In

my table it runs nearest to *C. marleyi* Ckll., but is not very similar, and will be known at once by the peculiar clypeus.

Colletes generalis Friese.

A female collected by R. E. Turner at Rapenburg, Cape Flats, Oct. 1920, is about 10 mm. long, and runs exactly to *C. generalis* in Friese's table—a species described from Grotfontein, in a very different environment. On comparing it with Friese's description, it nearly agrees, but the wings are appreciably dusky, the mandibles are entirely black and the claws are not red. The clypeus is strongly convex, with conspicuous longitudinal striæ; supraclypeal area shining; malar space extremely long, fully twice as long as wide; mesonotum dull, with a smooth median line, and a large polished area on disc; hair of thorax above dull white, with dark hairs intermixed, tegulæ almost black; stigma black; abdomen shining, the bands narrow and weak; scutellum and hind part of thorax with long slightly flavescent hair. This seems to be a distinct subspecies, which may be named *Colletes generalis australis*, subsp. n.

Colletes politulus, sp. n.

♀.—About 10 mm. long; black, with mandibles slightly reddened toward end, flagellum faintly fuscous below, hind legs clear red; malar space large, about as broad as long; clypeus flattened, shining, with distinct punctures, smallest and densest in middle of upper part; supraclypeal area very densely punctured, not shining; sides of face dull; hair of head white, on face only conspicuous at sides of lower part; mesonotum and scutellum highly polished; tegulæ small, brown; wings hyaline, stigma red; abdomen shining, with five bands of dense white felt, that on first tergite not much narrower than that on second, all the bands rather broad; venter with narrow but entire bands. The hair of scutellum is faintly flavescent.

Cape Province: Matjesfontein (type-locality), Nov. 1928 (R. E. Turner). Also taken by Turner at Somerset East, Nov. 1930.

This could be taken for *C. opacigenalis* Friese, to which it runs in Friese's table, but it is easily separated by the

highly polished first tergite. In my table in Amer. Mus. Novitates, No. 856, p. 1, it runs out at 4 because of the shining clypeus. On p. 2 (table of Friese species) it runs nearer to *C. opacigenalis* than anything else. Somerset East is about 90 miles north of Port Elizabeth.

Colletes stellatus, sp. n.

♀.—Length about 11 mm.; black, including mandibles, but flagellum brown beneath, hind legs with femora and tibiae red, knees narrowly black, a black mark at end of tibia; hind tarsi dark, almost black; the front legs are somewhat brownish; malar space about twice as broad as long; clypeus densely punctured, dull, shining at upper end; supraclypeal area hardly shining; hair of head rather dull white, of thorax above grey, a little reddish on scutellum, but no dark hairs intermixed; metathorax with no smooth area below the basal band; mesonotum dull in front, posteriorly polished; tegulae dark reddish brown; wings slightly dusky; stigma very narrow, dusky red with a dark margin; abdomen mainly dull, but first tergite polished, with extremely minute punctures; second tergite moderately shining; bands greyish, narrow; venter without distinct bands.

Cape Province: Stellenbosch, Sept. 17, 1923 (*C. J. Joubert*).

The following key will facilitate identification :—

- | | |
|---|---------------------------|
| First two tergites covered with long hair | <i>volkmanni</i> Friese. |
| First two tergites not so covered | 1. |
| 1. Malar space about twice as broad as long; hind margin of first tergite not red | <i>stellatus</i> , sp. n. |
| Malar space about as long as broad; hind margin of first tergite red | <i>comptoni</i> Ckll. |

Colletes suprafuscus, sp. n.

♂.—Length about 11 mm.; robust, black, including antennae and mandibles; front and middle legs black, with brownish tarsi; hind legs brown, the tibiae paler and more reddish on inner side and at end, the basitarsi reddish, with a dense brush of long silky hair on inner side; malar space about twice as broad as long; hair of head long and abundant, clear white, a little yellowish on vertex; mesonotum dull anteriorly, but polished posteri-

only, with large punctures; scutellum shining; thoracic hair long and abundant, white below, dorsally pale flavescent, with dark hair on disc of mesonotum and scutellum, giving a brownish appearance, on mesonotum there is white hair before and behind the dusky patch; tegulae red; wings somewhat dusky; stigma small and narrow, dusky reddish with a dark margin; basal nervure meeting nervulus; abdomen broad, dullish, first tergite covered with long white hair, second with a bluish glaucous appearance; abdominal bands white, shaggy, rather narrow.

Natal: Van Reenen, Drakensberg, Nov. 1926 (*R. E. Turner*).

Resembles *C. phenax* Ckll. (see below), but among other differences the transverse channel at base of metathorax in *C. phenax* is less evident, and there is no shining transverse area below it as in *C. suprafuscus*. *C. phenax* lacks the dusky dorsal hair, which is present in *C. fusconotus* Ckll., which has a shining abdomen with bands of dense tomentum, and the first tergite is not covered with hair.

Colletes faurei, sp. n.

♂.—Length about 8.5 mm.; black, including antennae, mandibles and legs; tegulae red; malar space well developed, but much broader than long; face very broad, it and cheeks with long white hair, but on vertex is yellowish; mesonotum shining, polished on disc; hair of mesonotum pale greyish fulvescent, contrasting with the bright red of scutellum; sides of thorax with fulvescent hair; white hair fringe on front tibiae behind exceedingly long; wings hyaline; stigma red with a dark margin; abdomen shining, with broad bands of fulvescent tomentum; ventral bands narrow, white, entire; on first sternite before the band there is a slightly reddish area.

Orange Free State: marked "S.V., Bf. x, April 8, 1928" (*J. C. F.*).

This differs from *C. martini* Ckll. by the shorter malar space and the fulvescent (instead of clear white) abdominal bands. *C. callaspis* Ckll. is smaller, with a much darker stigma, and narrow, whiter, abdominal bands. Bf. possibly stands for Bloemfontein.

There are two females, taken by Turner at Harrismith, Orange Free State, Feb. and March, 1927, which I thought

might belong with *C. faurei*, but they differ by the dull mesonotum, shining between the large punctures posteriorly. The dull mesonotum separates this form from *C. cluctallus* Friese, and the shining abdomen from *C. opacicollis* Friese. I have labelled these specimens *C. marleyi* Ckll., var., but it seems increasingly probable that the females assigned to *C. marleyi* represent more than one species.

Male *C. marleyi* was collected at Ficksburg, O.F.S.

Colletes andersoni, sp. n.

♀.—Length about 10 mm.; black, robust, flagellum very faintly brownish beneath; mandibles very faintly reddish subapically; legs with the tibiae and tarsi obscurely brownish; tegulae dark brown; malar space extremely short, almost obsolete; clypeus striatopunctate, moderately shining, with a little polished space in middle near apex; supraclypeal area dull; head with greyish-white hair, sides of thorax with the same, but slightly reddish in region of tegulae; mesonotum bare, perhaps denuded, dull, but shining between the large punctures posteriorly; scutellum large, dull, the front margin shining, a shining line down middle, continuous with that on mesonotum; hind margin of scutellum with a fringe of exceedingly long black hairs; wings very faintly dusky, not reddened, stigma small, dark brown; abdomen dull, except the broad shining brownish hind margins of tergites; first tergite strongly punctured, shining at top of descending basal part; abdominal bands of grey tomentum, narrow on first tergite, broad on the others; ventral bands subobsolete, only developed at sides.

British E. Africa: Kabete, 6000 ft., Dec. 20, 1918. (T. J. Anderson).

Related to *C. ruwenzoricus* Ckll., but that has bright red hair on scutellum, and a larger malar space. There is also some resemblance to *C. kivuicola* Ckll., from the Belgian Congo.

Colletes zonaturus, sp. n.

♀.—Length about 10 mm.; black, including antennae mandibles and legs; malar space extremely short, almost obsolete; face broad, quite densely covered with

dull whitish, faintly flavescient, hair; cheeks with white hair; thorax above with pale fulvous hair, that on scutellum like that of mesonotum, no dark hairs intermixed; tegulæ small, dark brownish; wings somewhat dusky; stigma small, reddish with a dark margin; abdomen with the first tergite covered with long, slightly fulvescent hair, only a little of the surface exposed before the apical band; bands on tergites 2 to 5 very broad, greyish, felt-like; no black hair before the bands; exposed parts of tergites shining, and venter shining, with weak bands.

Orange Free State: Ficksburg, Feb. to March 1932 (*L. Ogilvie*). In my table this runs near *C. malleatus* Ckll., but it differs in the malar space, the abdominal bands, and other characters. The disc of mesonotum is brilliantly shining, which separates it from *C. opacicollis* Friese and *C. parafodiens* Friese. In Friese's table it appears to go nearest to *C. abessinicus* Friese, which has similar hair on the thorax above, but quite a different abdomen.

Colletes opaciventris Friese.

Orange Free State: Harrismith, Feb. 1927 (*R. E. Turner*).

Three males; exactly this species.

Colletes rufotibialis Friese.

S. W. Africa: Swakopmund, April 2-4, 1928 (*R. E. Turner*).

Resembles *C. opacigenulis* Friese, but the broader abdomen is shining on second and third tergites. It is especially distinguished by the very long malar space, and the red hind tibiæ and tarsi. Three were taken.

Colletes lactescens, sp. n.

♀.—Length about 8 mm.; black, including antennæ and mandibles, but legs dark brown, with much white hair; tegulæ small, dark brown; malar space short, much broader than long, but not linear; face not nearly so broad as in *C. nanus* Friese (Egypt and Tunis); hair of face, cheeks, sides of thorax and metathorax pure white, of thorax above dense and pale fulvous, without dark hairs intermixed; clypeus exposed, highly polished, with widely scattered small punctures; scutellum with a

large triangular exposed shining area in front ; mesonotum somewhat shining, but almost entirely hidden by hair ; wings hyaline, slightly milky, the very small stigma pale reddish with no dark margin ; abdomen dullish, the tergites with very broad bands of fulvous tomentum, much broader than the intervals between ; hair of first tergite paler, very dense ; venter with white bands.

Sudan : Gendettu, Feb. 27, 1924 (*W. E. Giffard*). A species of typical desert aspect. It belongs to the group of *C. nanus*, where it is known by the comparatively narrow face, the milky hyaline wings, and the very broad fulvous bands of abdomen.

Colletes resedæ Cockerell.

Sudan : Erkowit, 1917, May 17 (*D. King*) and May 21 (*H. H. King*).

Colletes fusconotus Cockerell.

Natal : Kloof, 1500 ft., Sept. 1926 (*R. E. Turner*).

More robust than specimens from Merebank. Two females were taken by Turner at Port St. John, Pondoland, October 1923.

Colletes mitescens Cockerell.

Females from Van Reenen, Drakensberg, Natal, Nov. and Dec. 1926 (*R. E. Turner*), were at first referred to *C. malleatus* Ckll., but they do not differ appreciably from *C. mitescens*. *C. malleatus* was based on the male from S. Rhodesia, and in this sex, at any rate, is distinguishable from *C. mitescens*.

Colletes opacigenalis Friese.

Six males collected by Turner at Aus, Dec. 1929, have the hair of thorax above white, but five, taken December and January, have the scutellum more or less evidently reddish. Three females, dated Dec. 1929, run in my table near to *C. michaelis* Ckll., but that has the hair of mesonotum all red, and the sides of the thorax fulvescent. They are really very close to *C. marleyi* Ckll., but the males are certainly not that species.

The volsella of *C. opacigenalis* is much broadened at base, and resembles that of *C. malleatus* Ckll., but the terminal joint is large and long, much as in *C. marleyi*.

Colletes hirtibasis Cockerell.

Cape Province: Port St. John, Dec. 1923, two males (R. E. Turner).

Compared with the typical form from Ceres, they are appreciably larger, with longer, reddish hind tarsi. It is probable that with more material a distinct race might be defined.

A male *C. hirtibasis* comes from Worcester, Jan. 1929 (Turner).

Colletes phenax, sp. n.

♂ (type).—Length about 10.5 mm.; black, including mandibles, antennæ and legs, though the hind tarsi are dusky red; the mandibles, in a good light, appear more or less reddish except at base; malar space distinct, but much broader than long; face densely covered with pure white hair; hair of thorax copious, mostly white, but slightly flavescent dorsally, without dark hairs; tegulae small, red; wings dusky, stigma red with a dark margin, nervures dark; legs not modified, except that the hind femora are broad; abdomen shining, with five rather broad bands of dull white tomentum, the thin hair before the bands short and brown, venter simple, with entire white bands.

♀.—Similar, except for the usual sexual characters, but flagellum red beneath; malar space very short; hair of scutellum pale reddish, contrasting with that of mesonotum; front tarsi red apically, but hind tarsi black.

Cape Province: Mossel Bay, two males and three females, Dec. 1921 (R. E. Turner).

The male is so similar to that of *C. odontogaster* that at first I confused the two species, until I saw the very different legs. In my key, both sexes run near *C. malleatus* Ckll., from S. Rhodesia, which has the abdomen dull, and the first tergite differently punctured.

At Lady Grey, R. J. Nel took a female *C. phenax* (Dec. 19, 1924) and four males (Dec. 6 and 22, 1924, Feb. 3, 1925, Jan. 5, 1926).

Colletes martini Cockerell.

Cape Province: Lady Grey, two males, Feb. 4 and 12, 1925 (R. J. Nel).

They are smaller than the type, and the hind basitarsi are black. One has the hair of scutellum clear reddish, in the other it is practically white.

Two female *C. martini* were taken by Turner at Matjesfontein, Nov. 1928. One male is from Montagu, Oct. 1924 (Turner).

Colletes mediolucens, sp. n.

♀.—Length about 12 mm., black, mandibles with apical half red, flagellum dusky red beneath, legs mainly dark, but hind femora clear red, tarsi reddish apically; tegulae small, pale reddish; malar space well developed, but much broader than long; clypeus prominently exposed, very coarsely punctured, and shining; supraclypeal area with smaller punctures; front, sides of face, cheeks, and sides and under part of thorax with white hair; mesonotum with thin, short, dull white hair; scutellum with abundant long slightly flavescent hair; mesonotum dull and densely punctured, except the median disc, which is smooth and highly polished; the scutellum also is highly polished, without punctures, anteriorly; base of metathorax dull; wings short, clear hyaline; stigma small reddish with a dark margin; abdomen shining, minutely punctured; tergites with rather broad but thin hairbands, not at all conspicuous, but a conspicuous band of white hair at extreme base of second tergite; posterior margin of first tergite narrowly rufescent; no black hair on tergites before the bands; hair of venter very short.

Cape Province: Ceres, Nov. 1920 (*R. E. Turner*).

In Friese's table this runs near *C. testaceipes* Friese, which has all the legs red. In my table it runs out on account of the hair of scutellum not being red, the absence of black hair on thorax above, and the shining clypeus.

The species of *Colletes* collected by Turner at Ceres may be separated as follows:—

Males	1.
Females	5.
1. Small species with pure white hair of face contrasting with flavescent hair of thorax...	<i>albifrons</i> , sp. n.
Larger, or hair not thus contrasting	2. "
2. Small, approximately size of <i>C. albifrons</i>	3.
Larger species	4.
3. Hair of thorax above white	<i>albifrons</i> , var. a.
Hair of thorax above fulvous; abdominal bands fulvous (one, Dec. 1920)	<i>hirtibasis</i> Oskl.

- | | |
|--|-------------------------------|
| 4. Hind legs red ; hind margin of tergite 1 to 3 not red | <i>subrubripes</i> , sp. n. |
| Hind legs not red ; hind margins of tergites 1 to 3 red | <i>rubrovittatus</i> , sp. n. |
| 5. Small species ; thorax above without black hair | <i>albifrons</i> , sp. n. |
| Larger species | 6. |
| 6. Thorax above with much black hair (two, Dec. 1920 and 1924) | <i>sororcula</i> , (Kill. |
| Thorax above without black hair | <i>mediolucens</i> , sp. n. |

It will be noted that although *Coros* is hardly 75 miles from Matjesfontein, all the *Colletes* are different.

Colletes plebeius, sp. n.

♂.—Length about 9.5 mm.; rather slender, black, including antennæ, but mandibles red at end, and tarsi and extreme apex of middle and hind tibiæ, red ; malar space very short ; orbits strongly converging below ; head with abundant long white hair ; thorax with pale fulvescent hair, not mixed with dark, and somewhat fulvescent even on sides ; disc of mesonotum and anterior part of scutellum shining ; wings clear ; stigma small, red ; second submarginal cell smaller than usual ; abdomen shining, the tergites with rather narrow dull white hair bands ; venter with very weak narrow bands ; black hair on tergites before bands.

Cape Province : Mossel Bay, Dec. 1921 (*R. E. Turner*).

Resembles in some respects *C. opaciventris* Friese, but that has much broader bands on abdomen. In Friese's table it goes near *C. rufitarsis* Friese, but is actually quite different.

Colletes subrufipes, sp. n.

♂.—Length about 11 mm. ; robust for a male ; black, including mandibles and antennæ, but hind femora, tibiæ and tarsi chestnut red, and anterior tibiæ red in front ; the mandibles are very obscurely reddish toward the end ; malar space extremely short ; face very broad ; hair of face, cheeks and sides of thorax dull white ; of thorax above more greyish, posteriorly slightly fulvescent, some dark hairs on anterior part of scutellum ; mesonotum coarsely punctured, mostly dull ; tegulæ clear red ; wings very faintly dusky ; stigma small, reddish with a dark margin ; basal nervure nearly meeting nervules ; abdomen dullish, the first three tergites with a glaucous blue colour ; hind margins of first four tergites with

rather thin white hair-bands; apical tergites with black hair; venter with a strong subapical brush of pale yellowish hair.

Cape Province: Ceres, Nov. 1-12, 1924 (*R. E. Turner*).

In many respects this resembles *C. claripes* Friese, from Cape Town and Stellenbosch, but it does not show the ventral teeth on abdomen, the abdominal bands are not yellowish, and the hind femora are entirely red.

Colletes marleyi Cockerell.

In 'Entomologist,' Sept. 1933, I recorded a male *C. marleyi* from Ficksburg, O.F.S. I have now before me three females from that locality. Feb. to March 1932 (*J. Ogilvie, L. Ogilvie, A. Mackie*), and one from Natal: Kloof, 1500 ft., Sept. 1926 (*R. E. Turner*). But I also have a female, which seems to belong to the same species from Queenstown, C.P., 3500 ft., Jan. to Feb. 1923 (*R. E. Turner*). This, in turn, seems to agree essentially with the species from Kampala, Uganda, which has passed as *C. opacicollis* Friese, but is certainly not the species sent to me by Friese as *C. opacicollis*. I cannot believe that all these bees, from such widely separated localities, actually belong to a single species, but the matter must be elucidated by some future student, who has good series of both sexes.

Colletes laticaudus, sp. n.

♂.—Length a little over 11 mm.; black, including mandibles and legs, but flagellum brown beneath; face broad; malar space large, about as broad as long; clypeus shining, with convergent striæ; supraclypeal area polished, sides of front polished, with very small punctures; hair of head, and of thorax beneath and behind, dull white; thorax above with very short pale greyish (on scutellum slightly reddish) hair, with no black hairs; mesonotum dull in front, but the disc posteriorly brilliantly shining, sparsely punctured; disc of scutellum exposed, shining; tegulae very dark brown; wings faintly reddish, stigma very dark; hind tibiae posteriorly with a broad band of dense fulvous tomentum; abdomen very broad, shining, hind margins of first two tergites narrowly red, and traces of the same may be seen on third, abdominal hair bands clear white, moderately

broad, except that on first tergite, which is very narrow ; venter densely punctured, without distinct hair-bands.

Cape Province : Matjesfontein, Oct. 1928 (*R. E. Turner*).

By reason of the red tegumentary bands on abdomen, this may be compared with *C. rubrovittatus* Ckll., but that has an entirely different dull, abdomen. In Friese's table it runs closest to *C. opacigenalis* Friese, which differs in many respects.

LXXX.—*Note on the Ecdysical Changes of Growth in certain Terrestrial Isopoda.* By WALTER E. COLLINGE, D.Sc.

I HAVE long been interested in the ecdysis of the Terrestrial Isopoda, and in looking through voluminous notes on the subject made during the past thirty years, I find some which I consider should be recorded.

The study of different species in their various stages from leaving the brood pouch to reaching maturity, opens up a number of interesting questions relating to the evolution of the Oniscoidea. Schöbl, Weber, Friedrich, Leichmann, Němec, Schönichen, Herold, Aubin and others were more interested in the actual process of ecdysis rather than in the morphology of the species at different periods of life.

Heeley* is the only investigator that I am acquainted with who has described and figured the various stages of growth from the first to the sixth moult, and from these very valuable and interesting observations, he came to the conclusion that there was a distinct parallelism between the order in which distinguishing characters arise and such characters he regards as fundamental, and although these may not be shown at the earliest stages, they appear a little later in development. He states, " that during the first seven days after liberation from the brood pouch, all the species possess lateral lobes on the head, whilst *Porcellio* spp. and *O. asellus* possess a frontal lobe also. The lateral lobes disappear in *Ph. muscorum* later in development, and the frontal lobe disappears similarly in *O. asellus*. Thus in this respect the different members of one and the same family show in the young stages features common to all which are not shown by the adults."

* *Proc. Zool. Soc. ser. B*, 1941, iii. pp. 79-149, 15 figs.

"With regard to the lateral lobes, the entire absence of these in the embryonic stage of all the species suggests that they are not primitive characters, the head being in the first place perfectly oval. Their universal presence at a subsequent stage in development rather points to the assumption that they appeared later, but before the genera became differentiated; and in the case of *Ph. muscorum* their absence in the adults (and in *O. asellus* the absence of a frontal lobe in the adults) represents a reversion to the ancestral type rather than a true primitive condition. This conclusion, however, would require substantiation from other sources before it could be regarded as thoroughly justifiable."

In *Ph. muscorum*, bred in April, 1940, I noted, "Some of these after the second moult (approximately 18 days old) show distinct signs of lateral lobes, but after the fifth moult (approximately 73 days old) disappeared entirely. In one specimen, after the third moult (approximately 34 days old) there was a small, but distinct frontal lobe which disappeared after the fourth moult, just 21 days later."

In *Oniscus asellus*, in a brood bred in June, 1936, and again in one bred in August, 1940, I wrote, "There is a very distinct frontal lobe in some of these, which did not disappear until the fourth and fifth moult respectively. Again in *Ph. muscorum* hatched in May, 1935, three tiny excrescences could be distinguished on the frontal margin of the cephalon. These were noticed after the second and third moults but disappeared after the fourth moult."

In newly hatched specimens of *Ligia oceanica*, kindly sent to me by Lieut. T. Warwick from Isle of Eigg, Inner Hebrides, there were distinct signs of lateral and frontal lobes. There also occurred in a specimen of this same species an incipient frontal lobe." This specimen was kindly sent to me by Mr. C. I. Paton, from Castletown, Isle of Man.

From my own observations I would suggest that the above-mentioned characters indicate a primitive condition rather than a reversion to an ancestral type. They are not newly acquired characters, but the persistence of primitive ones (as evidenced in the early stages of *Ph. muscorum* and *O. asellus*) which disappear in the adult.

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